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AND
MAGAZINE OF NATURAL HISTORY.

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH *LOUDON* AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

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VOL. II.—TENTH SERIES.  
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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini ex œconomia in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Chyenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

"..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas
Ite, recurvato variata corallia trunco
Velite muscosis e rupibus, et mihi conchas
Ferte, Dææ pelagi, et pingui conchylia succo."
N. Purpureus Giannettan, Ecl. 1.

No. 7. JULY 1928.

I.—*Studies on Cirripeds in the British Museum (Nat. Hist.).*
By C. A. NILSSON-CANTELL, Fil. Dr., Sweden.

INTRODUCTION.

Since my paper on barnacles in the British Museum, London, was published (1927 *a*) I have been able, during a sojourn at the Museum in the summer of 1927, to study new collected material and other specimens not observed by me at the first visit. The loan of the material made it possible definitely to determine it. This new material also contains much of interest. Descriptions and discussions will follow here under the different species. By comparison of the literature and also the types in the Museum some synonyms have been found. As there was abundant material of several species, younger stages have been figured and described. Many of the specimens were taken by English cable-ships belonging to the Eastern and Associated Telegraph Companies. A good many new localities are to be noted.

Ann. & Mag. N. Hist. Ser. 10. Vol. ii.

DESCRIPTIONS.

Genus SCALPELLUM.

Scalpellum stearnsi, var. *inerme*, Annandale (1905). (Fig. 1.)

Scalpellum inerme, Annandale (1905), Pilsbry (1907 a).

Scalpellum stearnsii, var. *gemina*, Hoek (1907 a), Pilsbry (1911).

Scalpellum stearnsii, var. *inerme*, Annandale (1916 a).

Discussion and complementary description.—Annandale described (1905) a new species (*Sc. inerme*) with highly degenerated capitular valves. A variety of *Sc. stearnsii*, viz *gemina*, also with degenerated valves, was established by Hoek (1907 a). Pilsbry (1907 a) considered *inerme* to be distinct, and added (1911) that *Sc. stearnsii gemina* = *Sc. inerme*. Since more material has been studied, Annandale himself (1916 a) holds *inerme* to be an extreme form of Hoek's *gemina*. I think this form with degenerated valves may be described, as Annandale proposed, as var. *inerme*. It is certainly not possible to base a new subspecies only on the various degrees of calcification. Intermediate forms between var. *robusta* (identical with the typical form; Nilsson-Cantell, 1921) and *gemina* were found by Annandale (1916 a).

As in many species of *Scalpellum* this material, consisting of six individuals, shows that the younger specimens have more calcified valves. The smallest individual (length of capitulum 15 mm.) with fully developed valves (fig. 1 a, d) could with difficulty be distinguished from typical *stearnsii*. But somewhat larger ones (length of capitulum 17 mm.) show the commencing reduction especially in the *tergum* (fig. 1 b, e). The oldest specimens have valves of the same shape as figured by Annandale and Hoek. It is of interest to study the gradual development of the tergal part of the *scutum*: the umbo moving more and more from the apex (fig. 1 d, e, f).

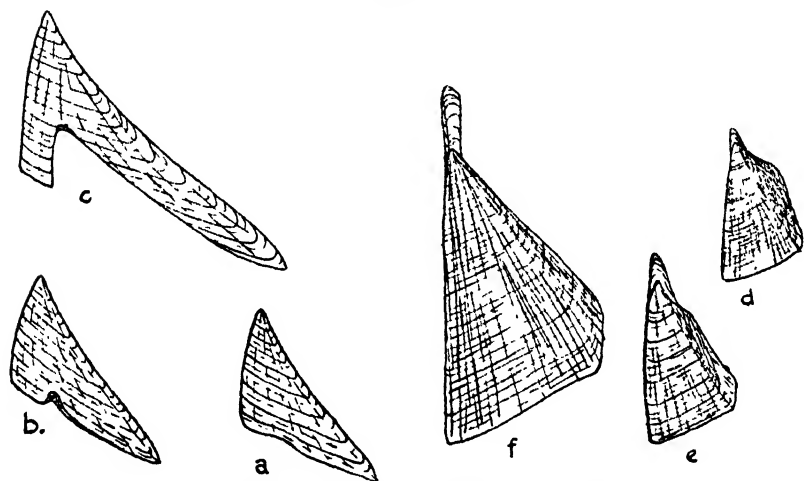
The length of the *peduncle* in these individuals varies, being relatively shorter in the smaller than in the larger ones, but in no specimens is it longer than the capitulum. Annandale and Hoek mention individuals with peduncle longer than the capitulum. As already (Nilsson-Cantell, 1921) pointed out, much variation in this regard exists in the typical form.

Measurements (in mm.):—Length of capitulum 35, 20, 15; breadth of capitulum 21, 12, 10.5; length of peduncle 30, 12, 7.5; breadth of peduncle 12, 6, 5.

Internal parts are described by the authors. Concerning the mouth-parts there is nothing to add. The differences in

the number of the segments on the cirrus i. and the caudal appendage noted by Pilsbry are in the opinion of Annandale "not beyond the limits of variation," which will here be proved. Cirrus I. with 9 and 14 segments; caudal appendage with 10. In Annandale's description of *inermis* for cirrus I. 10 and 15, for caudal appendage 9; in Hoek's of *gemina* for cirrus I. 9 and 16, for caudal appendage 6 segments are given. For typical *stearnsii* may be noted: (after Pilsbry) for cirrus I. 12 and 16, for caudal appendage 6 segments; according to specimens determined by me in 1921 as typical *stearnsii*, 12 and 15 respectively 6 segments. The smaller variations of about 1-3 segments in the rami of

Fig. 1.



Scalpellum stearnsii, var. *inermis*, Annandale.

a, b, c, right terga, different stages; d, e, f, right scuta, different stages.

cirrus I. and 4 in the caudal appendage are, I think, individual.

New locality.—S.E. of Great Nicobar, lat. $6^{\circ} 15' N.$, long. $93^{\circ} 35' E.$, 1040-1120 fathoms (1903-2050 m.), 30. iv. 1925. Pres. by Eastern and Associated Telegraph Companies.

Distribution.—The variety hitherto only found in the Malay Archipelago, but by Annandale supposed to exist in the Indian Ocean, is thus noted from the eastern part of the Ocean, and remarkably enough from a much greater depth than for this species before.

Scalpellum scalpellum (Linné, 1767).

One old specimen (collected 1870) in the collection of the Museum was labelled as a new species (*Sc. subtruncatum*) by an unknown author. This name is not to be found in the literature. Even in a superficial examination it is seen that the individual is a typical *Sc. scalpellum* well known from the Atlantic Ocean.

Locality.—Ireland, off Valencia, 112 fathoms (205 m.), coll. by Norman.

Scalpellum velutinum, Hoek (1883).

Syn. Nilsson-Cantell (1927 a).

Of this species some new finds are here noted.

New localities.—Portuguese East Africa, lat. 13° 27' S., long. 40° 47' E., 600 fathoms (1080 m.). Mozambique Channel, 900 fathoms (1647 m.). Both finds were taken by C./S. 'Lady Denison Pender.' Pres. by Eastern and Associated Telegraph Companies.

Distribution.—Nilsson-Cantell (1927 a). According to Weltner (1922) the species was taken before from the East African coast, but from a northern locality (lat. 1° 48'·2 N., long. 45° 42'·5 E., 1644 m.).

Scalpellum sociabile, Annandale (1905). (Fig. 2.)

Scalpellum sociabile, Annandale (1905, 1908).

Scalpellum pellicatum, Hoek (1907 a).

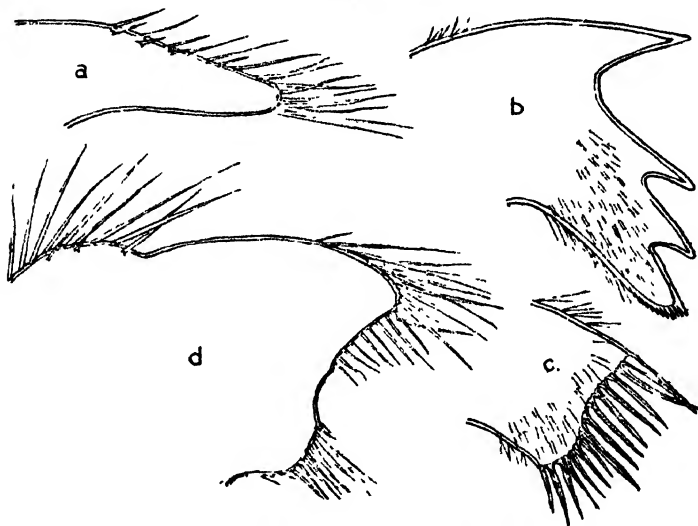
Scalpellum sociabile, vars. *pellicatum* and *parviceps* (nov.), Annandale (1916 a).

Discussion and complementary description.—Many individuals of this species are here met with. Characteristic for *Sc. sociabile* and also figured by Annandale (1905) is that the specimens were attached to each other. By the same author (1916 a) *Sc. pellicatum*, Hoek (1907 a), is mentioned as only a variety of *sociabile*, as he has been able to study variations of his own species. When I studied the type of Hoek's species in the 'Siboga' material, I found it quite identical with *Sc. sociabile*, of which I have seen a co-type in the British Museum. The free apex in Hoek's species is probably, as Annandale thinks, an abnormality. Such characters as broader capitulum and shorter peduncle with close-set scales are, in my opinion, not of such value that *Sc. pellicatum* can be put forward as a variety. In this material specimens are represented which in this respect

have maintained the same measurement as Hoek's figured species.

The new var. *parviceps*, Annandale (1916 *a*), with longer peduncle, widely separated scales, strong development of the cuticle, stouter and more quadrate capitulum with relatively smaller plates is, I think, only a full-grown specimen of the typical form. As my material contains specimens of different ages, one can find older specimens with more separated valves. The longer peduncle is in this case a character of no importance. Living *Sc. scalpellum*, a species with very

Fig. 2.



Scalpellum sociabile, Annandale.

a, palpus; *b*, mandible; *c*, maxilla I.; *d*, maxilla II.

similar peduncle, is able to draw together and extend the peduncle.

These specimens have a green colour in contrast to the purplish and white before described, perhaps due to the conservation.

A new species (*Sc. portoricanum*) was described by Pilsbry (1907 *a*) from a depth of 25–76 fathoms, and is very similar in external parts to this species. If the typical internal parts had been described it would perhaps have been possible to rank it as synonymous with Annandale's species. Now I hesitate to connect these nearly antipodal species.

Mouth-parts in *Sc. sociabile* are described by Annandale and Hoek. As figures only are given for the mandibles a figure of the appendages is given here.

Labrum after Hoek "with extremely small teeth." In the specimens only a few very minute ones could be traced.

Pulp conical.

Mandible has three teeth and a pectinated inner angle. As an abnormality Annandale mentioned two and a blunt inner angle. In the one mandible a small tooth at the tip of the inner angle was situated as in Hoek's.

Maxilla I. without a notch but with an inward curvature under the upper stronger spine, the lower part being slightly convex. The spines are nearly of the same size.

Maxilla II. has a spineless notch on the front edge and a posterior not always differentiated lobe with spines.

Measurements (in mm.):—Length of capitulum 19; breadth of capitulum 11; length of peduncle 10; breadth of peduncle 5.

Number of segments of the Cirri * :—

I.	II.	III.	IV.	V.	VI.	Caudal appendage.
10 12	20 21	25 25	25 26	29 29	28 28	5

The *caudal appendage* has the very broad basal segment, which is characteristic; number of segments about 4–5.

New locality.—S.E. of Great Nicobar, lat. 6° 15' N., long. 93° 35' E., 1040–1120 fathoms (1903–2050 m.), 30. iv. 1925. Pres. by Eastern and Associated Telegraph Companies.

Distribution.—Malay Archipelago and neighbouring waters. Hitherto the species was noted from a depth of 130–500 fathoms (238–915 m.).

Scalpellum alcockianum, Annandale (1906). (Fig. 3.)

Scalpellum alcockianum, Annandale (1906*b*, 1907, 1913, 1916*b*), Calman (1918).

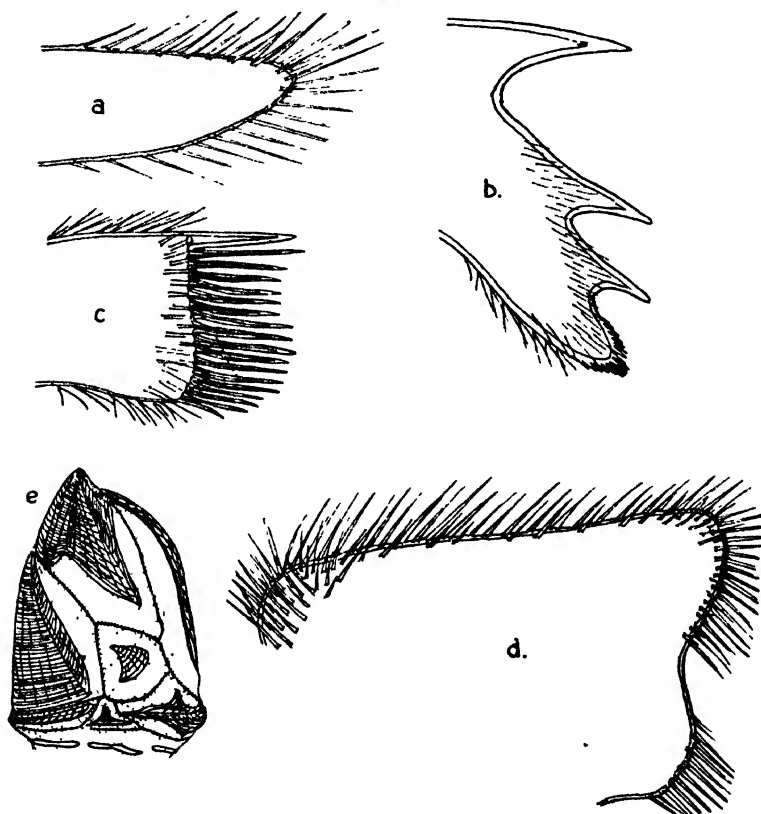
Discussion and complementary description.—One of the two here determined specimens has the much inflated capitulum mentioned as being characteristic. The removing of the very thick cuticle shows that the shape of the plates can be variable in some degree. Annandale says that varieties may be expected to occur in which the valves are relatively larger. That is the case in the figured specimen. Tergum, for instance, is not so much reduced as in the figure by

* Number of segments are referred to the same individuals for which measurements are given.

Annandale (1916 *b*), margo scutalis not being so much hollowed out. On the capitulum of both specimens individuals of *Megalasma pilsbryi* were situated.

Sc. giganteum, Gruvel (1901), from the Atlantic Ocean, is, as Annandale pointed out, closely related, which is seen

Fig. 3.



Scalpellum alcockianum, Annandale.

a, palp; *b*, mandible; *c*, maxilla I.; *d*, maxilla II.;
e, the animal, lateral view.

from the figures, especially by Pilsbry (1907 *a*). Yet there are some differences—as, *e.g.*, the less hollowed scutal margin. Another important difference, in my opinion, is the very short, only four-jointed caudal appendage in *Sc. giganteum*. For the present they may be separated. In the same group

Sc. persona, Annandale (1916 a), is to be separated by some differences from the two above-mentioned.

Of *internal parts* figures are given for the mandible, maxilla I., and cirrus VI., with the caudal appendage by Annandale (1907). For comparison fig. 3 is given.

Mouth-parts.—*Labrum* with minute teeth.

Palpus is conical with spines round the whole margin.

Mandible has three teeth and a pectinated inner angle.

Maxilla I. with nearly straight edge without a notch. Bristles uniform.

Maxilla II. large, with a notch without spines on the middle of the front edge. The upper margin is long with a continuous row of bristles.

Measurements (in mm.):—Length of capitulum 43, 50; breadth of capitulum 30, 38; length of peduncle 21, 22; breadth of peduncle 16, 18.

Number of segments of the Cirri:—

I.		II.		III.		IV.		V.		VI.		Caudal appendage.
9	12	22	27	33	34	37	38	36	40	36	39	27

The individual was a female.

In Annandale's specimen, with a total length of 77 mm., there was a cirrus VI. with 45 and 47 segments and a caudal appendage with about 30 segments (from the fig. 2, pl. ii. (1907)). Some variation always exists, but, like Gruvel, I do not think the caudal appendage varies so much as from 30 down to 4 (in *Sc. giganteum*).

New locality.—Mozambique Channel, 900 fathoms (1647 m.). C./S. 'Lady Denison Pender.' Pres. by Eastern and Associated Telegraph Companies.

To the localities previously registered from the Indian Ocean and the Malay Archipelago there is to be added a new one for a specimen determined by Dr. Calman and not published: between Australia and New Zealand, lat. 37° S., long. 165° E., 800 fathoms (1464 m.).

Distribution.—Indian Ocean, Malay Archipelago, south-western part of the Pacific Ocean.

Scalpellum elongatum, Hoek (1883). (Fig. 4.)

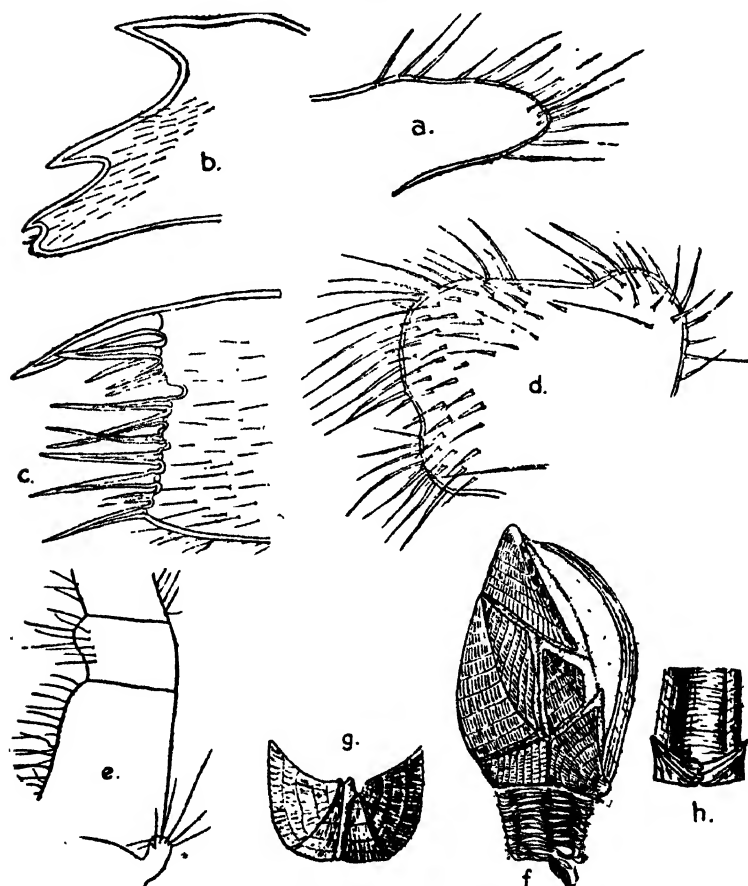
Scalpellum elongatum, Hoek (1883), Gruvel (1905).

? *Scalpellum striatum*, Gruvel (1900, 1902 a, 1905).

Discussion and complementary description.—The specimen here dissected I have found identical with the types of *Sc. elongatum*, Hoek (1883), on comparison in the Museum. As the individual is a little older than Hoek's, the plates

have been more separated by chitinous interspaces especially wide between carina and the plates lying nearest. On that account the specimen has not the same appearance as Hoek's.

Fig. 4.



Scalpellum elongatum, Hoek.

a, palpus; *b*, mandible; *c*, maxilla I.; *d*, maxilla II.; *e*, cirrus VI. and caudal appendage; *f*, the animal, lateral view; *g*, rostrum and rostral latera; *h*, carina and carinal latera.

As the external parts have been described by Hoek a figure of the individual is given (fig. 4 *f, g, h*). With its distinctly striated plates this is a very beautiful species, as Hoek has

already pointed out. Hoek (1883) says: "The rostrum is not distinct." The rostrum in the type is present, but covered by the rostral latera as I have seen also on many other of his types. The peduncle is short, but a little longer than in Hoek's figure.

For the *internal parts* no description has existed. It is given here.

Mouth-parts.—*Labrum* concave, armed with smaller teeth.

Palp conical, blunt.

Mandible with three teeth and a tooth-like inner angle near to the third tooth. The interval between the first and the second tooth twice that between the second and the third. It seems as if there has been some pectination on the inner angle.

Maxilla I. has a straight edge with a distinct notch beneath the larger upper spines. The other spines are very equal in strength and size.

Maxilla II. large, quadrangular, with a slight notch on the middle of the front edge. In the posterior part of the upper edge there is a prominence covered with bristles.

Measurements (in mm.):—Length of capitulum 25; breadth of capitulum 15; length of peduncle 8; breadth of peduncle 8.

Number of segments of the Cirri:—

I.	II.	III.	IV.	V.	VI.	Caudal appendage.
9 11	20 21	24 26	27 28	— 29	— 29	1

Cirrus I. short with rami of unequal length. The shorter ramus thick. Cirrus VI. with 5–6 pairs of spines on the front edge. The caudal appendage is one-jointed and very minute, with long bristles at the top.

No penis. *Complemental male* was not found.

Old localities.—Island of Tristan da Cunha; off Sydney; off East Cape, Auckland. From 60–1100 fathoms (110–2013 m.).

New locality. — Madras–Penang cable. Between lat. $7^{\circ} 11' 45''$ N., long. $93^{\circ} 9' 9''$ E., and lat. $7^{\circ} 14' 15''$ N., long. $93^{\circ} 9' 9''$ E. Pres. by Eastern and Associated Telegraph Companies.

Affinities.—A very closely related species is after Gruvel (*Sc. striatum*, Gruvel (1900)) with the syn. *Sc. rigidum*, Aurivillius (1898), from the Atlantic Ocean. Judging from Gruvel's figure (1902 a, pl. ii. fig. 1) there is a very wide chitinous interspace between the carina and the neighbouring plates as in the specimen described here. The differences

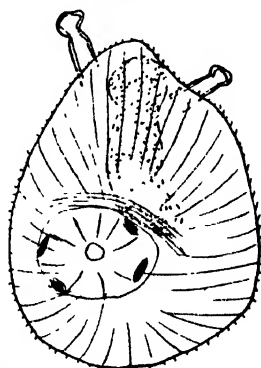
pointed out by Gruvel are perhaps due to the age. As I have also found in Hoek's type-specimen a rostrum which is present in *Sc. striatum*, it seems to me very questionable if this later species can be maintained. As no internal parts like the caudal appendages are known, the synonymy is not quite proved. Other, in my opinion, closely related species owing to the one-jointed caudal appendage are *Sc. vitreum*, Hoek (1883), and *Sc. formosum*, Hoek (1907 a).

Scalpellum discoveryi, Gruvel (1906). (Fig. 5.)

Scalpellum discoveryi, Gruvel (1906, 1907 a), Borradaile (1916).

Complementary description.—Of this species, reidentified by Borradaile from the 'Terra Nova' Expedition, stations 340 and 356, there were further two undetermined specimens

Fig. 5.



Scalpellum discoveryi, Gruvel. Complementary male.

in the collection of the Museum from the same expedition, but from a new station (no. 294).

I dissected a full-grown specimen in order to know the *internal parts*. About these we only know what Gruvel says: "Pas de pénis. Pas d'appendices terminaux ou filamenteux."

Mouth-parts.—(No figures are given, as the individuals are in a bad condition.)

Labrum without teeth.

Palp conical, pointed, with bristles along the one edge and at the point.

Mandible with three teeth and a pectinated inner angle.

Maxilla I. without a notch, with few spines.

Maxilla II. pointed. The front edge concave with bristles continuous. A posterior lobe with bristles is differentiated. Behind this a maxillary lobe with the opening for the maxillary gland.

No penis, filamentary and caudal appendages could be traced.

Complemental male was met with at the inside of the left scutum. It was not in a good condition, but a figure could be made. The male was much reduced, sack-like, with four minute valves. The antennæ are near the one of the poles. The sack provided with muscular bands. At the side near the opposite pole a small lobe was situated with the mantle-opening. Round this four much reduced valves.

Measurements (in mm.):—Length of capitulum 10; breadth of capitulum 5; length of peduncle 11; breadth of peduncle 2.

Number of segments of the Cirri:—

I.		II.		III.		IV.	
9	10	13	14	—	15	—	14

Cirrus I. with rami unequal in length. The longer cirri have long segments with four pairs of spines on the front edge.

No penis, filamentary and caudal appendages as Gruvel already has stated.

Affinity.—The species is said to be near to *Sc. intermedium*, Hoek (1883), which species has four-jointed caudal appendages and a sack-like complemental male with four rudimentary plates.

New locality.—‘Terra Nova’ station no. 294, lat. 74° 25' S., long. 179° 3' E., 158 fathoms (289 m.).

Distribution.—Antarctic, the southern part of the Pacific Ocean.

Genus LEPAS.

Lepas anserifera, Linné (1767).

Syn. Nilsson-Cantell (1921).

Five typical specimens of this species with five filamentary appendages and curved caudal appendages.

New locality.—Farsan Islands, Red Sea. Pres. by W. A. Macfayden, Esq.

Lepas anatifera, var. *testudinata* (C. W. Aurivillius (1892)).

Lepas testudinata, C. W. Aurivillius (1892, 1894), Gruvel (1902 b, 1905).

Lepas anatifera, var. *c*, Jennings (1915, 1918).

Lepas affinis, Borradaile (1916, 1917).

Discussion and complementary description.—When the new

and very characteristic variety from the southern seas, *non-furcata* of *L. anatifera*, was described (Nilsson-Cantell (1927 a)), the var. *c* of the same species was discussed. This is, as Borradaile (1917) first stated, synonymous with *L. affinis*, Borradaile (1916). I was at that time inclined to hold them syn. also with *L. testudinata*, C. W. Aurivillius (1892), but, as I had not seen all the material I wanted, I had to wait for more material and for a study of Aurivillius's type-material. There was reason for such a research, as in the rich material of *Lepas* species in the Museum I found some specimens described as *L. hillii*. By comparison it was established that they must be identical with the above-mentioned. In Darwin's dry material also some specimens very like those with the more projecting tergum were represented*.

At the time when *L. testudinata* was described it was justifiable to create a new species, and, as before mentioned (Nilsson-Cantell (1921)), these *testudinata* individuals are easy to identify. But as the differences are not of specific value, as will be discussed below, this species may be reduced to a variety *testudinata* of *L. anatifera* with the synonyms *L. anatifera*, var. *c*, and *L. affinis*, only collected from the southern parts of the oceans.

The plates are rather thin and finely striated, as is seen in the type-material, but some variation is possible. Gruvel (1902 b) describes specimens of *L. testudinata* in the Museum of Paris with very thin and translucent plates. As typical characters the straight occludent margin of the capitulum and the more projecting tergum may also be mentioned.

* In the determination of *Lepas* species many mistakes are made, because the difficulties here are greater than has been supposed. This is also pointed out later on by several authors. For instance, *L. anatifera* is sometimes determined as *L. hillii*, unless the internal parts (e. g., the filamentary appendages) are examined. For *L. hillii* it is quite right to mention as a character: "carina standing a little separate from the other valves" (Darwin), but also in individuals of *L. anatifera*—especially the larger ones,—which is a very variable species, a rather wide interspace can be traced. In such cases some other characters called typical by the authors must be treated carefully. On studying some larger *Lepas* specimens from William Head, B.C., determined by I. Cornwall (1925) as *L. hillii*, having large interspaces on capitulum, I found them to be typical full-grown *L. anatifera*. Of this species I have seen many individuals in several museums. The scuta in these individuals have, according to Cornwall, no internal umbonal teeth, but after removing the thick cuticle such could be traced on the right scutum and also a very small one on the left. This is a variable character in this species as Weltner (1900) and Broch (1924 a) have stated. The filamentary appendages in the specimens dissected were the typical two as for *L. anatifera*.

But it is not of specific value, since typical *L. anatifera* can have almost the same appearance. The interspace between the carina and other plates is rather wide, but smaller than in *L. hillii* (also mentioned for typical *L. anatifera* individuals, see the footnote, p. 13). Capitulum was in all I have seen rather laterally compressed. Scutum has in no examined specimen umbonal teeth, which also is stated by the cited authors. The præ-umbonal part of the carina is already figured for the type-specimens (Nilsson-Cantell (1927 *a*), fig. 5 *c, d, e*). As will be seen, there is some variation in the development of the prongs. But as Gruvel (1902 *b*) established for individuals from the Cape of Good Hope, they are never so strong as in *L. hillii*. Other characters, as, *e. g.*, the size of the angle between the præumbonal and postumbonal part of the carina are of little systematic value. The peduncle is never lighter in the upper part as in *L. hillii*.

Measurements of the British Museum individuals (in mm.):—Length of capitulum 22, 15; breadth of capitulum 14, 9; length of peduncle 67, 29; breadth of peduncle 7, 4.

Mouth-parts offer in genus *Lepas* no characters of specific value (Nilsson-Cantell (1921), p. 234). By way of control specimens of my material and the type-material were dissected. The mouth-parts were in all like those of typical *L. anatifera*. As figures are given for mandible and maxilla 1. by Aurivillius and Jennings, only a few remarks are needed here. The *mandible* has the characteristic five teeth and the pectinated inner angle. *Maxilla 1.* with three step-like projections. In this no differences from typical *L. anatifera* can be found as Aurivillius supposed. The character mentioned by Jennings as to the number of spines at the upper angle of the appendage, which is of importance for distinguishing *L. australis* from *L. anatifera* and *hillii*, is, as I have seen, a variable character. In the individuals in the British Museum two *filamentary appendages* could also be seen as in typical *L. anatifera*. The same number is given by all the authors cited here, and this circumstance forms good reason for grouping them under *L. anatifera*. The *caudal appendages* have small comb-like spines over the whole surface.

Affinity.—The discussion in the original description is consequently no longer valid in the light of the new view. The most related species is in Aurivillius's opinion *L. fascicularis* as mentioned there, which in all respects is very different from other *Lepas* species as *L. anatifera*.

New locality.—New Zealand.

Distribution.—The southern hemisphere: Africa, round

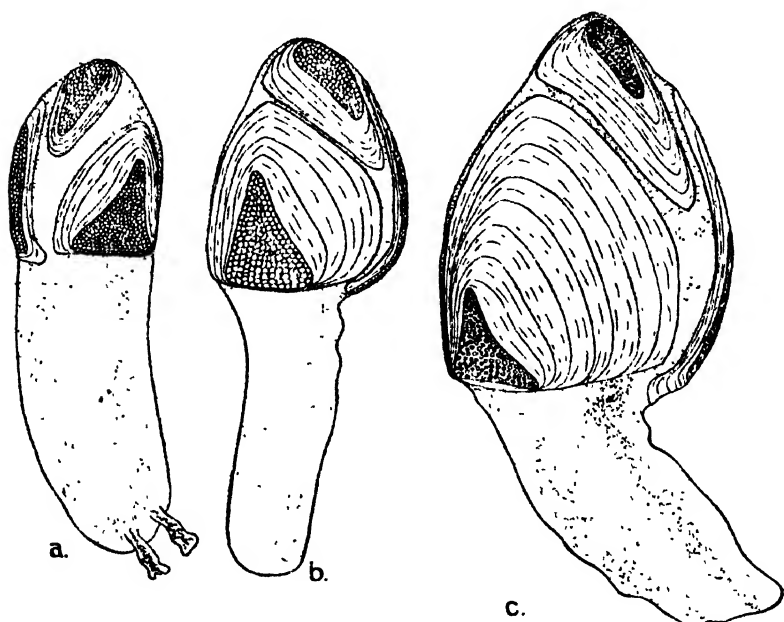
Cape of Good Hope ; Australia (Cambridge beach) ; New Zealand ; Kermadec and Chatham Islands. The distribution is thus wider than originally for *L. testudinata* was supposed—a very common circumstance in the case of such pelagic forms as the *Lepas* species.

Lepas hillii (Leach), Darwin (1851). (Fig. 6.)

Syn. Nilsson-Cantell (1921).

Complementary description.—Some specimens of this very characteristic species were here as often associated with

Fig. 6.



Lepas hillii (Leach), Darwin.

a, young specimen leaving the pupa stage with primordial valves and beginning development of the calcareous plates (total length 3.2 mm.); *b*, *c*, older specimens with more developed plates (total length 3.5 and 4 mm., respectively).

Conchoderma virgatum (Spengler (1790)). As my material also contains some young individuals, I here will give some figures to show the shape of the plates, as there were no previous figures of this species. For other *Lepas* species

figures are given, as, *e.g.*, by Broch (1922, 1927 *b*) for *L. pectinata*. I believe there are differences in some of the *Lepas* species in the shape of primordial plates, especially in the scutum. It will consequently be of value for the future to have figures of all young *Lepas* species, so that single young individuals can be identified.

The youngest stage (fig. 6 *a*), having just left the pupa stage, has not lost the prehensile antennæ. The oldest individual in which I could discover primordial plates had a total length of 10 mm. The largest individual figured was 4 mm. in total length (fig. 6 *c*). If we compare the size of the primordial plates we find them a little smaller in older individuals than in younger ones. The primordial plate of the scutum is here of a typical shape. As the calcareous plate begins to develop the apex is more removed from the occludent border, which is the case also in *L. anserifera*, but not in *L. pectinata*, from my observations.

New locality.—Galapagos Islands.

Genus CONCHODERMA.

Conchoderma virgatum (Spengler (1790)).

Syn. Nilsson-Cantell (1921).

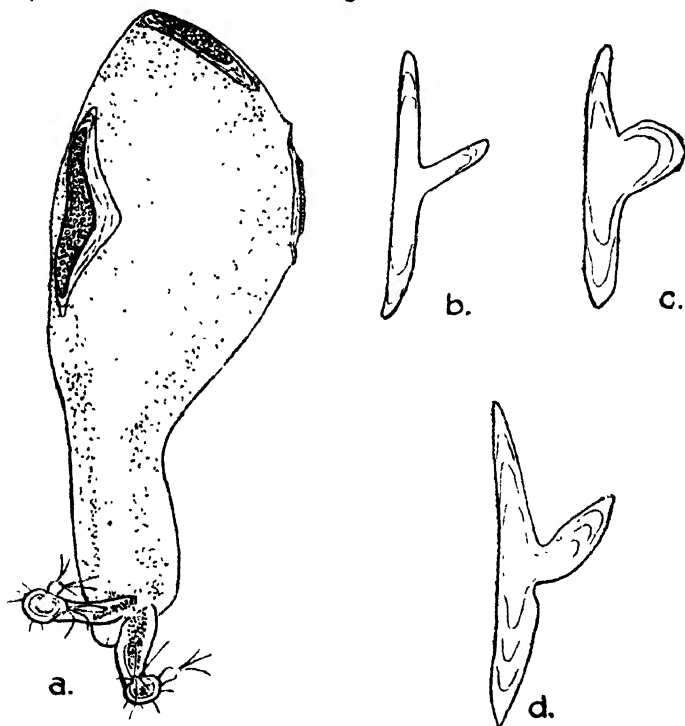
Complementary description.—As mentioned before, this species was found together with *L. hillii* and is represented here by individuals of different ages.

The smallest specimen I found is here figured (fig. 7 *a*) to show the shape of the primordial plates. A young but older individual is figured by Broch (1924 *a*) without any traces of primordial valves. It is of interest to study the calcified plates. Fig. 7 *b, c, d* shows that great variability prevails in the form of these, especially in the scutum, even in individuals from the same locality. Because of that I think many varieties based on those characters are a little uncertain. Annandale, who has discussed these varieties, makes (1909, p. 82) the following remark: "I do not consider it advisable to divide the species into subspecies or local races, it must be acknowledged that it is possible to distinguish several varieties which have a certain stability." In some individuals *scutum* was more like that of var. *hunteri* (fig. 7 *b, d*), in others more as in the typical form (var. 1). In full-grown specimens the *tergum* was "somewhat sinuate" as in var. 1, Annandale (typical form). In very young

specimens, as, *e. g.*, that figured, it was nearly straight, which was characteristic for var. *hunteri*. *Carina* arched as is typical in most individuals.

New locality.—Galapagos Islands.

Fig. 7.



Conchoderma virgatum (Spengler).

a, young specimen leaving the pupa stage with primordial valves and beginning development of the calcareous plates (total length 3.5 mm.); *b, c, d*, scuta of specimens of different ages (total length 18, 30, and 85 mm., respectively).

GENUS HETERALEPAS.

Heteralepas (*Heteralepas*) *japonica* (C. W. Aurivillius (1894)).

Syn. Nilsson-Cantell (1927 *a*).

Several larger and smaller typical individuals of this species may here be noted (Discussion, Nilsson-Cantell (1927 *a*)).

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Localities.—Banjoewangi — Port Darwin cable, Rotti Straits, 10 fathoms (18 m.), C./S. 'The Cable.' Pres. by Eastern and Associated Telegraph Companies.—Madras—Penang cable, off Nicobar. Pres. by Eastern and Associated Telegraph Companies.

Genus OCTOLASMIS.

Octolasmis warwicki (J. E. Gray (1825)).

Dichelaspis warwicki(?), Darwin (1851), C. W. Aurivillius (1894), Gruvel (1905), Annandale (1909).

Dichelaspis equina, Lanchester (1902), Gruvel (1905), Annandale (1906 a, 1908, 1909).

Octolasmis warwicki, Nilsson-Cantell (1925).

Of this species two small individuals (total length about 2 mm.) were identified, both in a bad state. For the locality they may here be mentioned.

New locality.—Lat. 10° 26' S., long. 123° 43' E., 15 fathoms (28 m.). Pres. by Eastern and Associated Telegraph Companies.

Distribution.—South China Sea to Indian Ocean.

Octolasmis orthogonia (Darwin (1851)). (Fig. 8.)

Dichelaspis orthogonia, Darwin (1851), Gruvel (1905), Hoek (1907 a), Weltner (1922).

Octolasmis orthogonia, Pilsbry (1911), Broch (1922), Nilsson-Cantell (1925).

Dichelaspis weberi, Hoek (1907 a).

Octolasmis weberi, Krüger (1911), Barnard (1924).

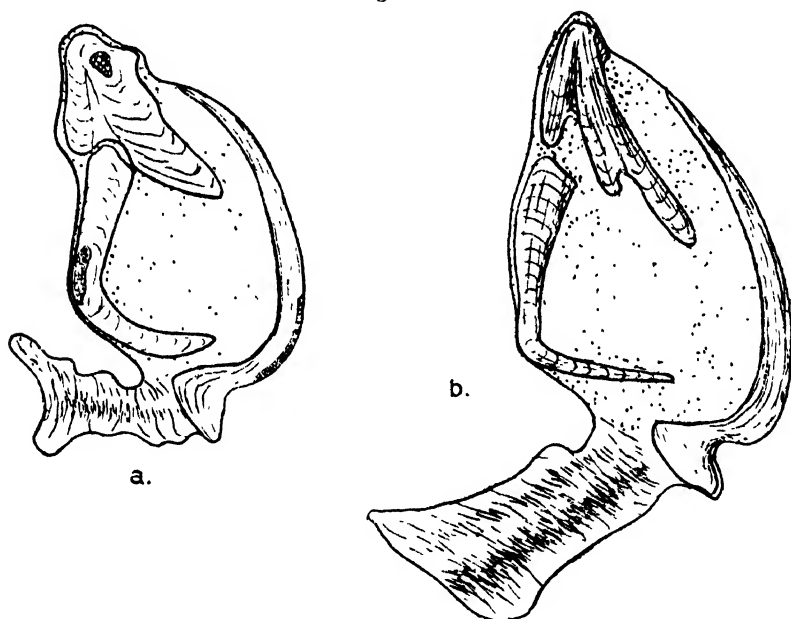
Dichelaspis versluysi, Hoek (1907 a).

Discussion.—On the peduncle of *Heteralepas japonica* two individuals of this species were situated. Both were very much like those figured by Hoek (1907 a, pl. iii. 1 A, 1 B) of *O. orthogonia* (Darwin (1851)). It is noteworthy that the tergum in smaller individuals has another shape than in older ones. Scutal margin has only two prominences (fig. 8 a) in the young specimen, and in that more like *O. warwicki* (J. E. Gray (1825)). This young specimen has not lost the primordial valves. The carina is not divided into two plates as is the case in some other species of *Octolasmis*, as, e. g., *O. warwicki* (J. E. Gray (1825)) and *O. nierstraszi* (Hoek (1907 a)). Pilsbry (1911) holds *O. orthogonia* (Darwin (1851)), *weberi* (Hoek (1907 a)), and *versluysi* (Hoek (1907 a)) to be local races of one species, and Krüger (1911) also points out the similarity between *weberi* and

versluysi. On studying the types of Hoek in the Amsterdam Museum I came more and more to the same opinion that there can be smaller variations in the valves of no specific value. Especially, *O. versluysi* resembled the larger specimen here described and also *O. orthogonia* in the 'Siboga' material. The differences in the form of the disc of the carina seem only to be variations.

New locality.—Banjoewangi—Port Darwin cable, Rotti

Fig. 8.



Octolasmis orthogonia (Darwin).

a, small specimen with primordial valves, lateral view ;
b, somewhat older specimen, lateral view.

Straits, 10 fathoms (18 m.). C./S. 'The Cable.' Pres. by Eastern and Associated Telegraph Companies.

Distribution.—Malay Archipelago—Japanese waters north to Sagami Bay, South Africa (Barnard for *O. wellneri*) and East African coast (Pemba Channel) (Weltner for *O. orthogonia*). From the beach to 447 fathoms (818 m.). By uniting the species mentioned, *O. orthogonia* has obtained a wider distribution in south-west direction to South African waters. Its bathymetrical distribution is also very wide.

Genus MEGALASMA.

Megalasma (Megalasma) minus, Annandale (1906).

Megalasma striatum, subsp. *minus*, Annandale (1906 b, 1907).

Pæcilasma bellum, Pilsbry (1907 c).

Megalasma minus and *bellum*, Pilsbry (1907 b).

Megalasma lineatum, Hoek (1907 a).

Megalasma minus, rac. I. & II., Annandale (1909).

Megalasma minus, Calman (1919), Broch (1922), Barnard (1924).

The four specimens examined here had the same appearance as the individuals figured by Annandale (1907, pl. i. fig. 8), Hoek (1907 a, pl. iv. fig. 1), and Broch (1922, fig. 31 a). As a new reason for the uniting of *M. bellum* (Pilsbry (1907 c)) and *M. minus*, Annandale (1906 b), Barnard points out the variability in the mandibles.

One specimen was situated on *Sc. stearnsii*, var. *inermis*, Annandale (1905), the three others on *Sc. sociabile*, Annandale (1905). Scutum was exactly twice as high as wide, as in the typical form.

New locality.—S.E. of Great Nicobar, lat. 6° 15' N., long. 93° 35' E., 1040–1120 fathoms (1903–2050 m.), 30. iv. 1925. Pres. by Eastern and Associated Telegraph Companies.

Distribution.—Indian and Pacific Ocean, 161–1120 fathoms (295–2050 m.).

Megalasma (Glyptelasma) gigas (Annandale (1916)).

Pæcilasma (Glyptelasma) gigas, Annandale (1916 a).

Megalasma (Glyptelasma) gigas, Calman (1919).

This species is very characteristic through the transverse processes at the base of the carina. To the description by Annandale there is nothing to add. They may be noted for the localities.

New localities.—Lat. 9° 6' 15" S., long. 116° 27' 10" E. C./S. 'The Cable.' Pres. by Eastern and Associated Telegraph Companies; lat. 7° 15' 24" N., long. 92° 59' E. C./S. 'Patrol.' Pres. by Eastern and Associated Telegraph Companies.

Distribution.—Indian Ocean, Malay Archipelago.

Megalasma (Glyptelasma) pilsbryi, Calman (1919).

(Fig. 9.)

Megalasma (Glyptelasma) pilsbryi, Calman (1919).

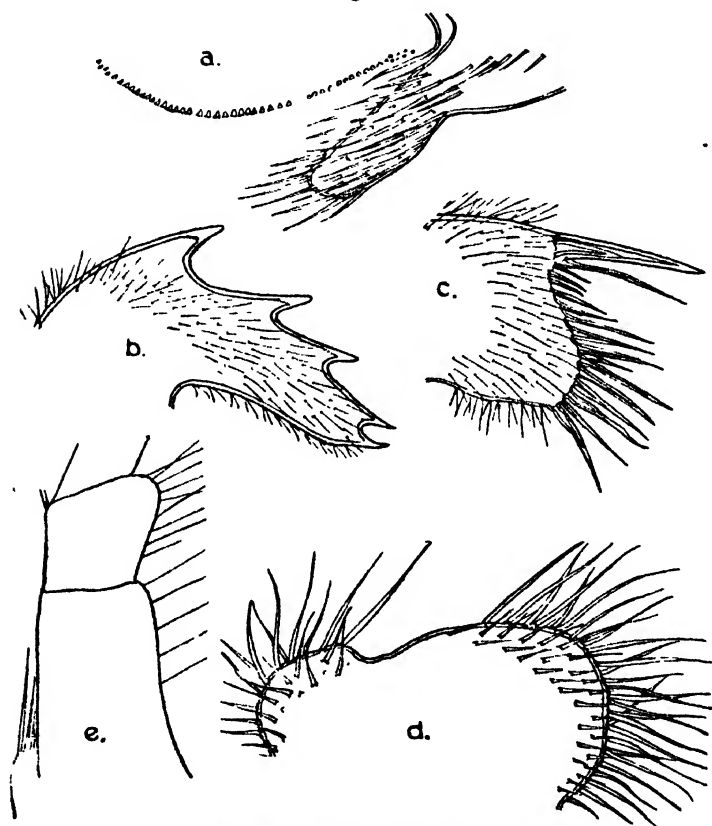
Complementary description.—To the original description some complementary additions may be added for the *internal parts*.

Mouth-parts.—*Labrum* concave with strong teeth.

Palp conical, blunt.

Mandible with four teeth and a lower tooth-like angle. Some variation is noticeable here. The lower angle in one dissected specimen is sparsely pectinated and one additional tooth is situated between tooth 3 and 4.

Fig. 9.



Megalasma pilsbryi, Calman.

a, labrum and palpus; *b*, mandible; *c*, maxilla I.; *d*, maxilla II.; *e*, cirrus VI. and caudal appendage.

Maxilla I. with an inward curvature in the upper part and a projecting part below with strong spines.

Maxilla II. with straight, somewhat convex, front edge with bristles. A posterior upper lobe with bristles is differentiated.

Measurements (in mm.):—Length of capitulum 20; breadth of capitulum 9; length of peduncle 6; breadth of peduncle 4.
Number of segments of the Cirri:—

I.	II.	III.	IV.	V.	VI.	Caudal appendage.
9 11	19 21	— 23	— 23	— 24	— 24	1

Filamentary and caudal appendages as by Calman (1919).

New localities.—Lat. $9^{\circ} 6' 15''$ S., long. $116^{\circ} 27' 10''$ E. C./S. 'The Cable.' Pres. by Eastern and Associated Telegraph Companies.—Portuguese East Africa, lat. $13^{\circ} 27'$ S., long. $40^{\circ} 47'$ E., 600 fathoms (1098 m.). On *Scalpellum velutinum*. C./S. 'Lady Denison Pender.' Pres. by Eastern and Associated Telegraph Companies.—Mozambique Channel, 900 fathoms (1647 m.). On *Scalpellum alcockianum* and *velutinum*. C./S. 'Lady Denison Pender.' Pres. by Eastern and Associated Telegraph Companies.

Distribution.—Indian Ocean. This species, hitherto known from the eastern part of this ocean, seems to be distributed over the whole, as it is now registered from the western part.

Megalasma (Glyptelasma) orientale, Calman (1919).
 (Fig. 10.)

Megalasma (Glyptelasma) orientale, Calman (1919).

Complementary description.—To the original description some completing notes about the *internal parts* may be added.

Mouth-parts.—*Labrum* concave with strong teeth situated close together.

Palp conical with many bristles at the point and the side.

Mandible with four teeth and a tooth-like lower angle. The one appendage with an additional tooth between 2 and 3.

Maxilla I. with the lower two-thirds of the front edge projecting so as to form a step.

Maxilla II. with straight front edge with bristles. A posterior lobe with bristles is differentiated.

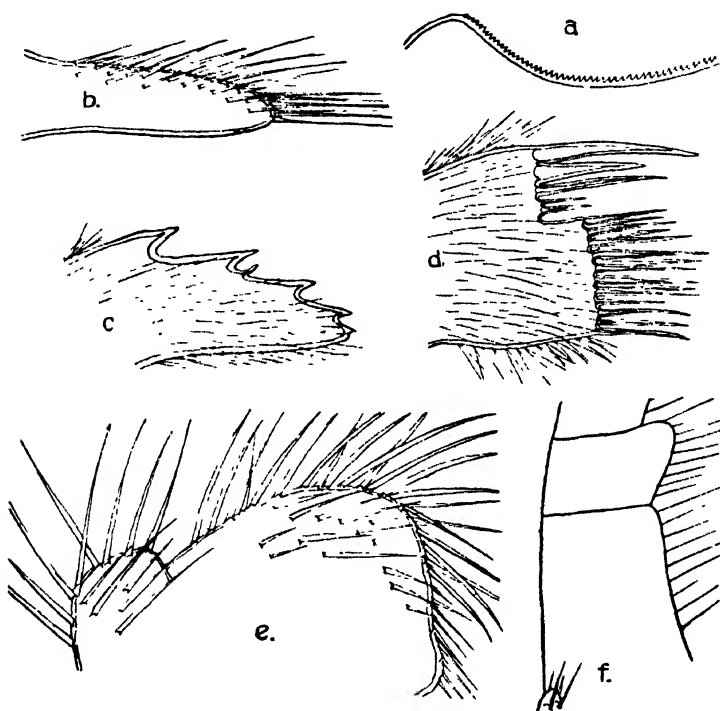
Measurements (in mm.):—Length of capitulum 26.5; breadth of capitulum 14.5; length of peduncle 5; breadth of peduncle 5.

Number of segments of the Cirri:—

I.	II.	III.	IV.	V.	VI.	Caudal appendage.
9 10	18 19	19 20	20 21	21 22	22 23	1

Filamentary and caudal appendages as by Calman (1919).
New locality.—Lat. $9^{\circ} 6' 15''$ S., long. $116^{\circ} 27' 10''$ E.
 C./S. 'The Cable.' Pres. by Eastern and Associated Telegraph Companies. The type-localities were situated near to this one here noted.

Fig. 10.



Megalasma orientale, Calman.

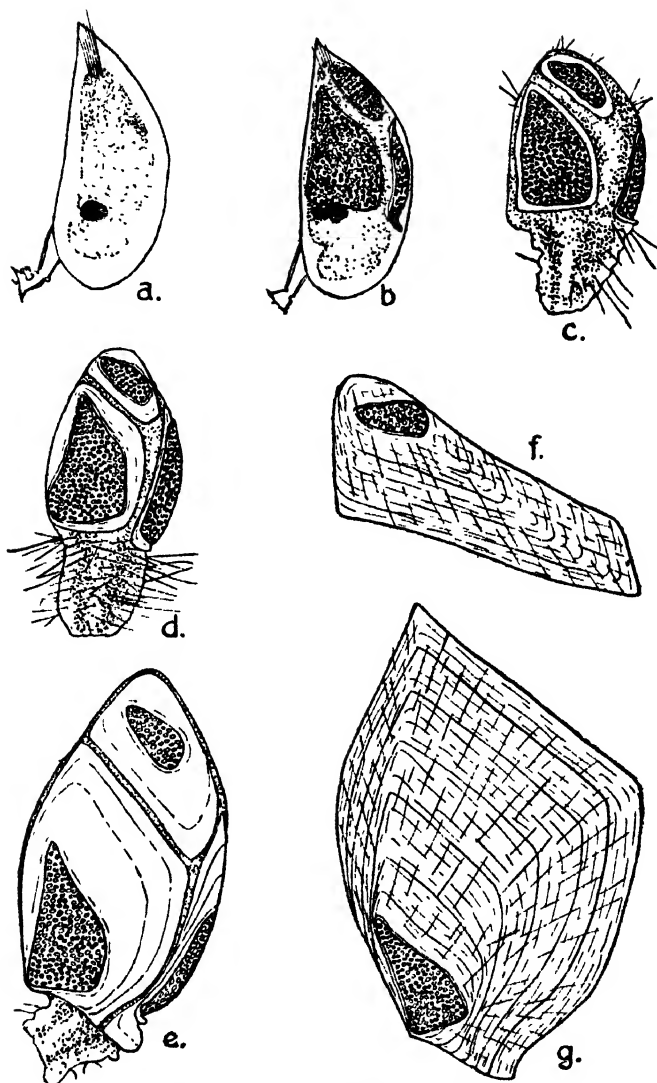
a, labrum; *b*, palpus; *c*, mandible; *d*, maxilla I.; *e*, maxilla II.;
f, cirrus VI. and caudal appendage.

Megalasma (Glyptelasma) hamatum, Calman (1919).
 (Fig. 11.)

Megalasma (Glyptelasma) hamatum, Calman (1919), Nilesen-Cantell
 (1927 a).

Complementary description.—To the previous description of the full-grown animal, nothing need be added here. As I had abundant material of individuals of different stages, a series of figures of the pupa just attached and the youngest stages

Fig 11.

*Megalasma hamatum*, Calman.

a, pupa just attached; *b*, pupa with primordial valves; *c*, *d*, *e*, young specimens showing the beginning development of the calcareous plates; *f*, *g*, tergum and scutum of a more developed specimen (length of capitulum 3.2 mm.)

with the primordial valves is given. The largest individual had a total length of 30 mm. For a species of the subgenus *Megalasma* (*M. striatum*) some early stages are figured by Broch (1922). The pupa of this species seems to be very like the one for subgenus *Glyptelasma* figured here (fig. 11 *a*). The next stage of *M. hamatum* which I found (fig. 11 *b*) has the same scape but with five primordial valves developed. But there are already differences from *M. striatum*, especially in the carina, which in the later species extends beneath the scutum. In *M. hamatum* thus the proximal part of the pupa is left free from plates. The shape of the tergum and scutum in the first stages is very like *M. striatum*. In the following stages (fig. 11 *c-g*) the calcareous plates begin to develop. The size of the primordial valves is nearly the same. The interspaces between the plates begin to be smaller. In stages *c* and *d* we see many bristles on the cuticle, especially on the peduncle. In the animal figured in 11 *e* the basal margin of the calcified scutum is not parallel with the basal margin of the primordial valve as in the first stages. Also through the development of the part below the primordial valve of the carina the basal margin of both plates is no longer transversal as earlier, but oblique, though not so much as in *M. striatum*. The oldest individual figured shows in the scutum (fig. 11 *g*) a more developed basal part. It should be noted that the primordial valve still has the same shape as before, but is getting smaller. It would be interesting to compare the stages of other *Glyptelasmæ*, but, as they are unknown, we must wait for that.

New localities.—Lat. $7^{\circ} 52' 38''$ N., long. $92^{\circ} 59' 13''$ E., C./S. 'Patrol'; lat. $7^{\circ} 15' 24''$ N., long. $92^{\circ} 59'$ E., C./S. 'Patrol'; lat. $7^{\circ} 57' 5$ N., long. $21^{\circ} 49' 5$ W., 2000 fathoms (3660 m.); lat. $7^{\circ} 51'$ N., long. $21^{\circ} 39'$ W., 1670 fathoms (3056 m.); lat. $13^{\circ} 27'$ S., long. $40^{\circ} 47'$ E. 600 fathoms (1098 m.), C./S. 'Lady Denison Pender.'

Madras—Penang cable, off Nicobar. On *Heteralepas japonica*. All presented by Eastern and Associated Telegraph Companies.

Distribution. Atlantic, Indian, and Pacific Oceans, 200–2000 fathoms (366–3660 m.).

Genus VERRUCA.

Section ALTIVERRUCA, Pilsbry, 1916.

Verruca gibbosa, Hoek (1883). (Figs. 12, 13.)

Verruca gibbosa, Hoek (1883), Gruvel (1905).

Verruca sulcata, Hoek (1883), Gruvel (1905).

Verruca bicornuta, Pilsbry (1916).

Verruca mitra, Hoek (1907 *b*).

Discussion and complementary description.—By studying a richer material of *Verruca*, as I was able to do at an earlier date, it was possible to state that great variation in the shell prevails. The material I have here dealt with shows the same. The numbers of the ribs on the carina and the rostrum, and the articular ribs on the movable tergum and scutum are particularly variable. Consequently many of the *Verruca* species described from single individuals are synonymous. As I was able in the British Museum to compare these specimens with the 'Challenger' Expedition-types of *Verruca*, I came to the conclusion that they could be determined as both *V. gibbosa*, Hoek (1883), and *V. sulcata*, Hoek (1883). In the key to the genera these are distinguished by the character "apex of the scutum projecting freely" in *V. sulcata* and "not freely" in *V. gibbosa*. As I have found this circumstance not constant by comparing the individuals in the 'Challenger' material and that dealt with here, I am of the opinion that the two species should be united. More detailed reasons are given later on in the description of the material.

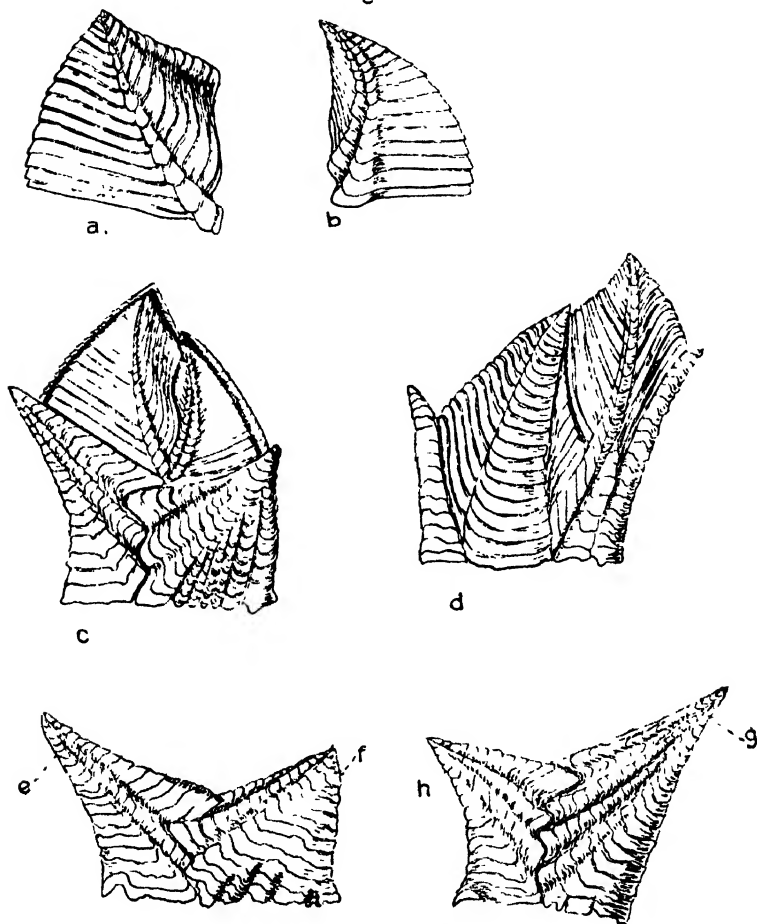
Some other species described later seem to be difficult to maintain. For one of these (*V. mitra*) Hoek (1907 *b*, p. 8) says: "Only investigation of a much richer material can prove whether these features really hold good to distinguish this form from the by all means nearly related species *Verruca gibbosa* and *Verruca quadrangularis*." The characteristic features, as, *e. g.*, the absence of the first articular ridge on the movable scutum and the great dimensions of the rostrum and the carina, are of no specific value, because they are variable characters, as I have found in this material. Hoek's figures may be compared with fig. 12.

Of the species first described by Aurivillius (1898) and later by Gruvel (1920) with figures, *V. costata* from the north part of the Atlantic Ocean seems to be near to *V. gibbosa*. A reason for keeping them separate is seen, perhaps, in the more depressed shell. Further material must be collected to prove that.

Another species described by Pilsbry from a single individual from the North Atlantic Ocean, viz., *V. bicornuta*, Pilsbry (1916), may here be discussed. The wall enlarges upwards while the specimen was situated on a small object. Pilsbry (1916, p. 44) says:—"This doubtless affected the shape of the walls, which enlarge upwards, more, I think, than they would on a supporting object of more ample dimensions." The main differences from *V. gibbosa* are seen in the interlocking ridges on the carina and the rostrum,

at least four in *bicornuta* and three (of these two smaller) in *gibbosa*. These are yet variable characters, as is seen from my material (fig. 12). In the movable plates no important

Fig. 12.



Verruca gibbosa, Hoek.

a, movable tergum; *b*, movable scutum; *c*, the animal from the side of the movable tergum and scutum; *d*, the same from the side of the fixed tergum and scutum; *e, g*, carina; *f, h*, rostrum from other specimens, showing the variation of these plates.

differences prevail. I am wholly convinced that *bicornuta* must be synonymous with *V. gibbosa*. According to Pilsbry, *V. rathbuniana*, Pilsbry (1916), is very near to *V. bicornuta*,

and consequently also related to *V. gibbosa*. I cannot decide now if *V. rathbuniana* "one of the largest and finest of the erect forms" is well defined.

My material consisted of five individuals and parts of a sixth. This is the largest Verrucid I have seen. The largest individual with a carino-rostral length of 12 mm. and height of 13.5 mm. Hoek's individuals are smaller, 9 and 8 mm. respectively for *V. gibbosa* and 5 and 5.5 mm. respectively for *V. sulcata*.

Movable scutum in these specimens with two well-defined articular ridges. The upper articular rib is weak, hardly distinguishable, and represented by a tergal area finely striated. Between the figures of the scuta of *V. gibbosa*, *sulcata*, *bicornuta*, and *mitra*, and fig. 12 *b* there are no important differences. The question whether the apex is free or not is of no specific value, as in Hoek's type-material I found individuals of *V. gibbosa* of both types. My material has most individuals with an apex not projecting freely; but there was also one specimen with a free apex.

Movable tergum in the specimens has the first articular ridge weak but developed, as is seen from the figures by Hoek (1883). The middle articular ridge in one specimen is as distinct as in the figures by the author mentioned; in the others (fig. 12 *a*) weaker. In *V. bicornuta* and *mitra* this rib can also be traced. In the type-material I found this rib in *V. sulcata* more weakly developed than in *V. gibbosa*. From Hoek's figures it is not possible to find such a difference. The diagonal rib well defined by all mentioned species.

The *carina* has an apex projecting more freely than that of the rostrum. The interlocking ribs on the rostrum and the carina are of interest as they are very variable in number and shape (fig. 12). Further, a variable number of longitudinal furrows on the rostrum and sometimes on the carina from the basal margin are worthy of note.

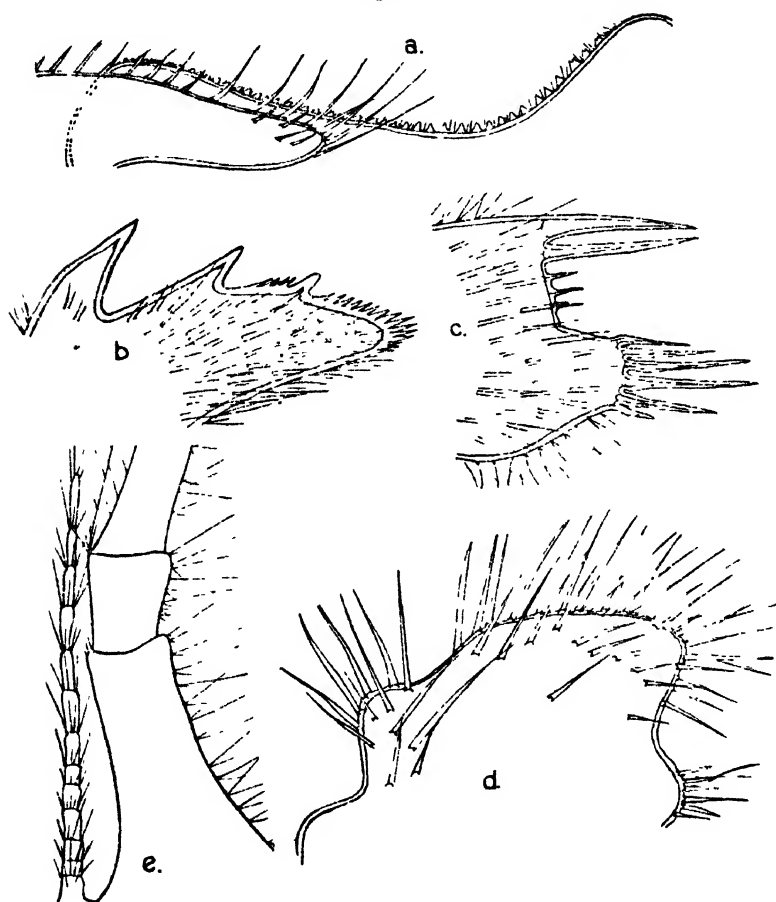
The *fixed scutum* and especially the *tergum* has wide radiiform areas (fig. 12 *d*), resembling in this the figures given by the authors cited. In one specimen the fixed scutum has longitudinal furrows from the basal margin.

The *basal opening* is more or less regular, depending on the supporting object.

The *mouth-parts* are only described by Hoek for *V. gibbosa*. The body of *V. mitra* has not been studied, but Hoek (1907 *b*, p. 8) says: "In many regards this structure would have been found, most probably, similar to that of *Verruca gibbosa*." It is of interest to compare the figures by Hoek (1883) and fig. 13. Great resemblance seems to exist.

Mandible with three teeth and a finely pectinated inner angle. Small teeth between tooth 2 and 3, as in Hoek's specimen.

Fig. 13.



Verruca gibbosa, Hoek.

a, labrum and palpus; *b*, mandible; *c*, maxilla I.; *d*, maxilla II.;
e, cirrus VI. and caudal appendages.

Maxilla I. has the very typical step-like projection as in Hoek's specimen.

Maxilla II. is bilobed with a notch without spines. A posterior upper lobe with bristles is differentiated. The

figure of this appendage by Hoek does not quite correspond to mine here (fig. 13 d).

Number of segments of the Cirri for an individual with a carino-rostral diameter 9.5 and height 12 mm.:—

I.	II.	III.	IV.	V.	VI.	Caudal appendage.
9 12	8 14	22 25	29 30	32 33	33 34	13

The relative length of the cirri as given by the authors mentioned.

New locality.—Lat. $7^{\circ} 51' N.$, long. $21^{\circ} 39' W.$, 1670 fathoms (3056 m.).

Distribution.—Atlantic Ocean (from lat. $41^{\circ} 7' N.$, to lat. $48^{\circ} 37' S.$, 1035–1710 fathoms). Antarctic Region (lat. $70^{\circ} S.$, long. $80^{\circ} 48' W.$, 303 fathoms). Pacific Ocean (near the Kermadec Islands, 520–630 fathoms).

By uniting some species with *V. gibbosa* this species has obtained a very wide distribution. This material from the middle part of the Atlantic Ocean thus links the localities given by Hoek for *V. gibbosa* from the south of the same ocean with those for *V. bicornuta* from the north. The localities from Antarctic for *V. mitra* may link up the localities for Hoek's *V. sulcata* from the Pacific Ocean. The species is, like most of *Verruca*, a typical deep-sea species, and therefore seems to have a cosmopolitan distribution.

Genus CHTHAMALUS.

Chthamalus fragilis, Darwin (1854). (Fig. 14.)

Chthamalus stellatus fragilis, Darwin (1854).

Chthamalus fragilis, Pilsbry (1916).

This species has been redescribed by Pilsbry and is here represented by a rather large specimen. *Chth. fragilis* is

Fig. 14.



Chthamalus fragilis, Darwin.

a, right scutum; b, right tergum.

characterized by the conical, smooth, and thin shell. This specimen has the wall folded like those figured by Pilsbry (1916, pl. 70, 3c). Externally there is some resemblance to *Chth. moro*, Pilsbry (1916), from the Malay Archipelago, which seems to be distinguished by the opercular valves. A thin brown cuticle covers the plates. The sutures have very distinct interlocking teeth. For comparison, figures of the *opercular valves* are given (fig. 14).

The internal parts showed great resemblance to those which Pilsbry found.

Locality.—West Indies, 1886. On *Balanus tintinnabulum*.

Distribution.—West Indies, north to Woods Hole, Massachusetts.

Genus *BALANUS*.

Subgenus *MEGABALANUS*, Hoek (1913).

Balanus tintinnabulum antillensis, Pilsbry (1916). (Fig. 15.)

Balanus tintinnabulum antillensis, Pilsbry (1916).

Complementary description.—One of the species dissected had *opercular plates* as figured by Pilsbry. The *parietes* were ribbed, white with reddish-purple lines as Pilsbry states. *Radii* white, but sometimes purple-coloured.

The *internal parts* are not described. Perhaps there are not many differences between the subspecies in these respects, but still figures are given as a help to further identifications of this subspecies.

Mouth-parts.—*Labrum* is hairy with three teeth on either side of the rather deep notch.

Palpus is club-shaped, elongated. The upper margin with feathered bristles; the front edge has longer bristles, such as are also found along a line above the lower margin.

Mandible on the one side with five teeth, of which the last is indistinctly separated from the lower point. On the other side the appendage has four teeth and a lower point. The second tooth is distinctly double and the third has an additional tooth.

Maxilla I. has a straight edge well marked from the upper and lower margin. Below the upper spines is a very minute notch. At the lower corner smaller spines are situated.

Maxilla II. is bilobate. The outer lobe with long bristles, the inner lobe is convex, also with long bristles.

Measurements (in mm.):—Carino-rostral length 33; height 32.

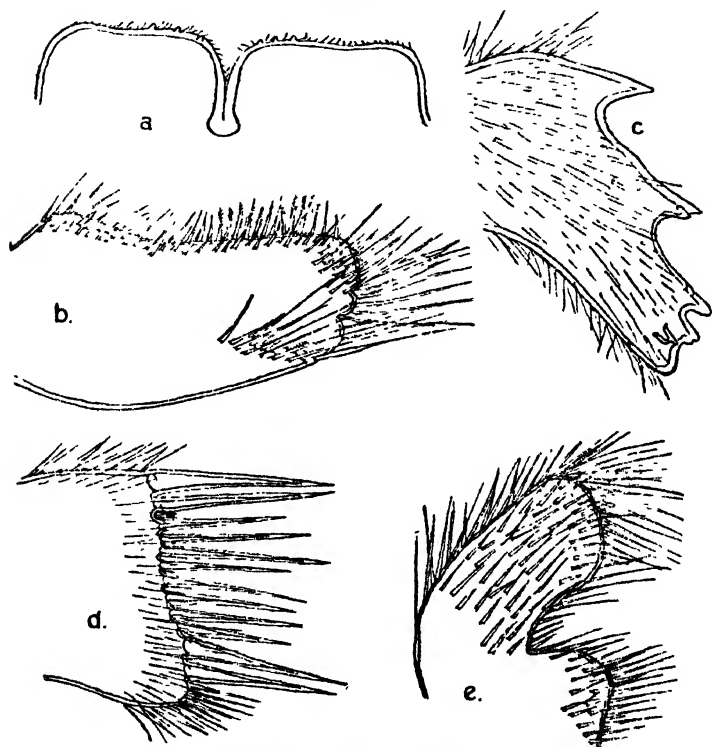
Number of segments of the Cirri :—

I.		II.		III.		IV.		VI.	
18	21	14	16	12	15	—	38	—	44

New locality.—Trinidad, 27. i. 1925.

Distribution.—West Indies to Rio de Janeiro.

Fig. 15.



Balanus tintinnabulum antillensis, Pilsbry.

a, labrum; *b*, palpus; *c*, mandible; *d*, maxilla I.; *e*, maxilla II.

Subgenus *BALANUS*, Da Costa.

Balanus eburneus, Gould (1841).

Balanus eburneus, Gould (1841), Darwin (1854), Weltner (1897), Gruvel (1903, 1905), Sumner (1911), Pilsbry (1916), Nilsson-Cantell (1921).

Balanus democraticus, De Kay (1844).

Two specimens of this characteristic species were here

identified from a European locality—I think, ship-carried individuals. Most localities are from American waters.

New locality.—Falmouth, England.

Balanus improvisus, Darwin (1854).

Balanus improvisus, Darwin (1854), Weltner (1897), Gruvel (1905), Pilsbry (1916), Borradaile (1916), Nilsson-Cantell (1921, 1927 *b*), P. Schaper (1921), Broch (1924 *a*).

Several dry specimens provisionally labelled as *B. calceolus* showed on closer examination no resemblance to this species. In reality, they should be described as *B. improvisus*. The individuals here had a conical, somewhat depressed shell with longitudinal hyaline stripes as in Darwin's var. *assimilis*, also noted from Trinidad, like these.

The *opercular valves* are in this species rather variable.

Scutum has the basal and tergal margin of the same length. The adductor ridge is straight and prominent. The valve comes nearest to that figured by Pilsbry (1916, pl. 24, 5 *b* and 5 *d*).

Tergum has the spur rather narrow and distally rounded with few (5–6) but prominent crests for the depressor muscles. The valve as that figured by Broch (1924 *a*, Taf. iii., 15 *b*).

Internal parts in those individuals which are dry are wanting.

Locality.—Trinidad, Gulf of Paria, off San Fernando. Collected by G. B. Reynolds, Esq., 1921. Obtained from oil-pipes.

Balanus amphitrite niveus, Darwin (1854).

Syn. : Nilsson-Cantell (1921, 1925).

Discussion.—It seems to me that these specimens ought to be determined as the subspecies *niveus*, which it is possible to identify, as Pilsbry (1916) has given complementary description with figures. It is very characteristic with the hyaline longitudinal lines. On studying the types of Darwin we must note the difficulties distinguishing them. Besides *niveus* there are other white varieties as *venustus*, *pallidus*, but insufficiently described as regards the opercular valves. For *venustus* a description of the valves is given later on (Nilsson-Cantell, 1925).

Broch (1927 *a*) describes a new forma *dentata* from Suez Canal. As I have been able to compare Broch's material with my own here described, I have to note differences in

the opercular plates. The plates here were of about the same appearance as those figured by Pilsbry for American specimens (1916, pl. 19).

Mouth-parts showed great resemblance to Pilsbry's individuals. *Labrum* with three teeth on either side of the notch. Broch describes a varying but large number of teeth by forma *dentata*, but specimens with three and two respectively are also figured. In the other mouth-parts no great differences prevail.

The *number of the segments* is nearly the same as with Pilsbry. The smaller variations due to age are of no great importance in a discussion of the subspecies and the varieties. On the cirrus III. the short decurved teeth on the lower segments as Broch also describes for *denticulata* are found. This is common in all individuals of *B. amphitrite*, Darwin (1854).

New locality.—Muscat, 8–10 fathoms (15–18 m.), 4. vi. 1914. On slag. Pres. by Major Knox. Pilsbry notes *niveus* only from American waters, but by Darwin it is mentioned from the Mediterranean (Red Sea) near to this locality.

Balanus trigonus, Darwin (1854).

Syn.: Nilsson-Cantell (1921).

Three specimens together with *niveus* are noted here from a locality not before seen in the literature for *B. trigonus*, Darwin (1854).

New locality.—Muscat, 8–10 fathoms (15–18 m.), 4. vi. 1914. On slag. Pres. by Major Knox.

Subgenus CONOPSEA, Say.

Balanus calceolus, Darwin (1854).

Balanus calceolus, Darwin (1854), Gruvel (1903, 1905, 1907 b), Hoek (1913), Pilsbry (1916), Broch (1922, 1924 b).

Complementary description.—Some dry specimens on a violet-coloured gorgonian were here examined. No traces of the bodies could be found, but opercular valves were left. After removing the covering tissue of the gorgonian the form of the plates and shell could be made out. The *parietes* seem at first sight to be solid but transverse sections show that they are indeed porous, which distinguishes the species from allied species like *B. proripiens*, Hoek (1913). *Basis* is also porous as in Darwin's and Broch's specimens. Pilsbry (1916) notes solid basis, perhaps an oversight or a variation.

Very near to *B. calceolus* is *B. investitus*, Hoek (1913), with an adductor ridge on the scutum. As internal parts of the types of *B. calceolus* are unknown, it is difficult to say whether later-described species are distinct.

As regards external parts some remarks may here be made. The elongation of the shell which is typical for the section varies much as Darwin has already pointed out. The material contains individuals more or very little elongated. Individuals situated on smaller stems I found more elongated. The deep pit for the lateral depressor muscle on the *scutum* and the absence of an adductor ridge may be mentioned as important characters. *Tergum* has the spur dentated as in Darwin's specimens.

New locality.—Sierra Leone, Plantains Islands, 7. ix. 1925. Pres. by the Director, Kew Gardens, London.

Old localities.—West coast of Africa (Darwin, 1854, Broch, 1924*b*); British East Africa (Gruvel, 1907*b*); Madras (Darwin, 1854); West Australia (Weltner, 1897); Malay Archipelago (Hoek, 1913, Pilsbry, 1916, Broch, 1922); New Guinea, Japan (Weltner, 1897); Mediterranean? (Darwin, 1854).

Genus TETRACLITA.

Tetracilita porosa rufotincta, Pilsbry (1916). (Fig. 16.)

Tetracilita squamosa rufotincta, Pilsbry (1916).

Tetracilita porosa rufotincta, Nilsson-Cantell (1921).

Complementary description.—Two specimens were here identified of the typical appearance even in the opercular valves shown by Pilsbry's figures. One specimen was dissected. As the *internal parts* are not known, a description with figures is here given. Further finds will prove whether differences exist between the subspecies in this respect.

Mouth-parts.—*Labrum* has a slight inward flexion at the middle. On each side are some strong teeth (two or three respectively). Along the edge are fine hairs.

Palp long, not pointed at the end, but rounded, consequently typical. Upper edge distinctly concave.

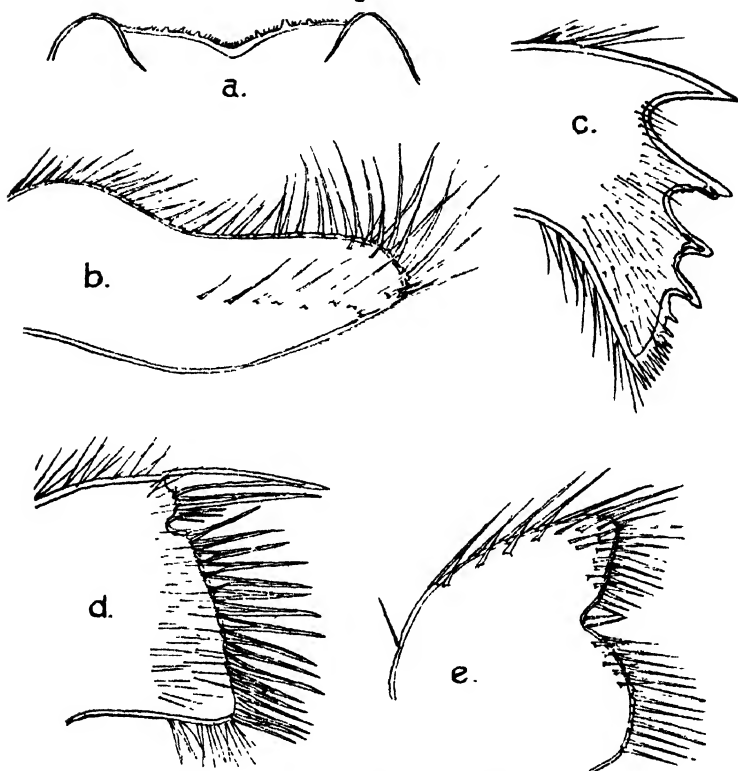
Mandible with four teeth and a strong pectinated region on the front edge below. Additional teeth on tooth 2 and 3.

Maxilla I. has straight front edge with well-marked inner angle. A distinct notch situated in the upper part.

Maxilla II. bilobed.

Measurements (in mm.):—Carino-rostral diameter 47; height 43.

Fig. 16.

*Tetrachita porosa rufotincta*, Pilsbry.

a, labrum ; b, palpus ; c, mandible ; d, maxilla I. ; e, maxilla II.

Number of segments of the Cirri:—

I.		II.		III.		IV.		V.	
15	25	15	17	15	16	21	22	—	25

New locality.—Muscat, 8. xii. 1902. Pres. by K. Kirkpatrick, Esq.

Distribution.—Gulf of Oman ; East coast of Africa down to Zanzibar ; Madagascar.

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II.—*Triassic Fossils from Brazil.* By F. R. COWPER REED, Sc.D., Sedgwick Museum, Cambridge.

[Plate I.]

THE various occurrences of marine Triassic beds in South America have been recently discussed by Jaworski (1), but none have been recorded in Brazil. For it has been believed that the Estrada Nova beds which succeed the Iraty shales in that country without any obvious break are of Lower Permian age. But Dr. Alex. L. du Toit has recently collected from two horizons in the upper part of these beds a few specimens of lamellibranchs which he has submitted to me, and after a long and detailed examination of them, and comparison with Permian fossils from various parts of the world, I am led to regard them to be of Triassic age on the strength of the marked resemblance of the majority of the species to well-known Triassic forms, and the evidence, so far as it goes, is opposed to the conclusion that we have to deal with a Permian fauna.

It is, however, probable that the Estrada Nova beds as at present defined are a compound group, and that the basal part may yet prove to be Permian.

In most cases Dr. du Toit's specimens are not well preserved, and some exist only as internal casts, and it is unfortunate that no more zoological groups or genera of critical value are represented in his collection. But it may be maintained with considerable confidence that the general facies of the fauna indicates an Upper Triassic age.

A provisional list of the fossils has been given (2) in Dr. Alex. L. du Toit's paper entitled "A Geological Comparison of South America with South Africa" (Publication No. 381, Carnegie Institution of Washington, 1927), but some corrections in the determination or comparison of the species are here made.

LIST OF FOSSILS.

Horizon 1:—

Pachycardia, aff. *rugosa*, Hauer (2).

Anodontophora, aff. *trapezoidalis*, Mansuy (6) (8).

Trigonodus sp. (9).

Radiolaria (1) (not determinable).

Horizon 2:—

Myophoria (*Myophoriopsis*), aff. *lineata* (Münst.) (11) (11 a) (16) (14).

— (—), aff. *carinata*, Bittn. (21).

Pachycardia neotronica, sp. n. (17) (22) (13) (11) (16) (19) (21) (15).

Megalodus, cf. *triqueter* (Wulf.) (20).

Lucina paranaensis, sp. n. (18) (23).

Modiola (*Septiola*), cf. *dreyssensiformis*, Waag. (12).

The numbers in brackets refer to the specimens in Dr. du Toit's collection as labelled by him.

HORIZON 1.

The specimens numbered 1–10 from this horizon in the Estrada Nova beds of Rio Claro, State of Paraná, occur in cherty and oolitic rocks, and are mostly very poor. Only three are satisfactorily identifiable.

Pachycardia, aff. *rugosa*, Hauer. (Pl. I. fig. 1.)

On one small slab of rock (No. 2) there are several more or less perfect specimens of a small lamellibranch about 15 mm. in length which have the shell preserved and seem to belong only to one species, though showing certain minor individual differences. But no interiors or hinge-characters are visible in any case, so that we have to trust to external features for their determination. The most perfect example consists of a right valve which is transversely subtriangular in shape and about one and a half times as long as high; it is subtruncate and broadly rounded in front; the beak is sub-anterior, high, broad, directed forwards, and slightly incurved;

below it the margin is somewhat excavated, but no distinct lunule can be seen; the posterior end of the shell has a subacute inferior angle, to which a raised, slightly sigmoidal, subangular umbonal ridge runs down to meet the nearly straight inferior margin at an angle of about 45° ; in front of this ridge the greater part of the surface of the valve is occupied by a broad, rounded, shallow, median depression, which is bounded rather suddenly in front by the gently convex anterior part of the shell; behind and above the umbonal ridge is the flattened narrow posterior area inclined nearly at right angles to the side of the valve. Rather strong but low sublamellose concentric growth-ridges and lines cross the whole surface.

The left valves are less well preserved, and seem to have the umbonal ridge more rounded and less prominent, the median depression also being less sharply defined.

Dimensions.—Length 15 mm.; height at beak 9.5 mm.

From the shape and external characters of this shell, we are led to refer it to the genus *Pachycardia* and to compare it with examples of *P. rugosa*, Hauer (3) (4), and *P. haueri*, Mojs. (5). Broili's first figured specimen of *P. rugosa* from the *Pachycardia* beds (*op. cit.* fig. 27), and *P. haueri*, as illustrated by Wöhrmann and Koken (6), from the Raibl beds, especially resemble our specimens in their well-marked median depression. No Permian shells seem to bear much resemblance to them; but their internal characters are, unfortunately, unknown.

Anodontophora, aff. *trapezoidalis*, Mansuy (pars).
(Pl. I. figs. 7, 8.)

A left valve of a transversely oval compressed lamelli-branch (No. 6) occurs in the shelly oolitic rock with part of the substance and surface of the shell preserved, but the posterior cardinal margin and end are broken. The beak is small, low, subcentral, and slightly directed forwards, and the upper half of the anterior margin below it is slightly excavated, but the lower half is well rounded; the inferior margin is strongly arched, and the posterior end seems to have been somewhat narrowed. A narrow, weak, straight ridge, probably arising from the umbo, strikes the postero-inferior angle of the valve and marks off a narrow, elongated, slightly inclined, posterior area. The surface of the shell is marked with raised concentric striæ of unequal strength. There is another specimen (No. 8) of a right valve having the same shape and proportions and exhibiting the internal

characters to some extent, but, unfortunately, the beak and hinge-line are imperfect. The posterior and anterior muscle-scars are well seen, and are rather large and submarginal; the hinge-line which is obtusely angulated at the beak is thickened, but does not clearly show the presence of any teeth.

Dimensions (No. 6).—Length 17 mm.; height 14 mm.

Remarks.—The generic reference of this shell seems to be *Anodontophora*, and it more resembles some of the specimens from the Trias of Na-Cham figured by Mansuy as *A. trapezoidalis*, Mansuy (7), than any European species, though it is rather shorter and broader in outline. We may also compare the better-known *A. griesbachi*, Bittn. (8), from the Upper Trias of the Himalayas. But it is possible that it should be placed in some other genus, for there is some difference of opinion amongst authors with regard even to well-known species referred to *Anodontophora*. Thus Assmann (9) puts *A. fassaensis*, Wissm., in *Pleuromya*.

Trigonodus sp. (Pl. I. fig. 9.)

One left valve (No. 9) of a small, much laterally compressed, transversely semielliptical or suboblong shell occurs in the collection, which is certainly distinct from the above-described shell referred to *Anodontophora*; but the specimen is poorly preserved and no internal characters are visible. The beak is low, small, and situated at about one-fourth the length of the valve from the anterior end, which is rather broadly rounded; the posterior end is somewhat narrowed, sharply rounded below, and obliquely subtruncate above; the lower margin of the valve is very slightly arched, the dorsal edge is straight and extends about three-fourths the length of the shell. A straight weak umbonal ridge runs down to the postero-inferior angle and cuts off a narrow, elongated, flattened triangular area from the general surface of the valve, which is compressed and flattened.

Dimensions.—Length 18·5 mm.; height at beak 12·5 mm.

Remarks.—This shell seems most like some young individuals of *Trigonodus rablensis* (Gredl.) (6*a*), and especially resembles those figured by Di-Stefano (10) from the Triassic dolomite of Palermo. We may also remark that the new species from the Trias of Tonkin which Mansuy (11) has figured as *Cypricardia garandi*, may be compared, and some of the figures of *Anodontophora tonkinensis*, Mansuy (7*a*),

from the Trias of the same region, bear a noticeable resemblance. The genus, therefore, must remain somewhat doubtful.

HORIZON 2.

The specimens numbered 11–23 from the second horizon in the Estrada Nova beds of Rio Claro, State of Paraná, a few kilometres to the west of Rio Claro occur about 40 metres higher than specimens 1–10, and as internal casts in a hard sandstone, the place of the shell itself being generally occupied by some soft earthy carbonaceous substance.

Myophoria (*Myophoriopsis*), aff. *lineata* (Münster).
(Pl. I. fig. 2.)

Shell triangular, longer than high, flattened on sides. Beak large, prominent, broad, swollen, rising well above hinge-line, directed forwards and incurved, subanterior in position, being situated at about one-fourth the length of the shell, with a shallow lunule below it; anterior end of valve narrowed and rounded, somewhat projecting below; inferior margin gently arched; posterior end obliquely truncated above, subacute at postero-inferior angle. Valve flattened laterally and in umbonal region, carinated posteriorly by a strong, angular, nearly straight, oblique umbonal ridge running to postero-inferior angle and rising near it into a weak, narrow, rounded rib, which bounds a flattened posterior area inclined at 90° – 100° to side of valve. Surface of shell smooth. Dentition unknown.

Dimensions (No. 11).—Length c. 34 mm.; height 23 mm.

Remarks.—There is one nearly perfect internal cast of a left valve (No. 11), with the impression of part of its external surface (No. 16), and a broken internal cast of another left valve (No. 14). This shell is undoubtedly allied to *Myophoriopsis lineata* (Münst.) (12) and to *M. rosthorni*, Boué (12a), of the European Upper Trias, while one of the shells from the Trias of Kashmir, figured by Bittner (8a) as *Myophoria*, ex aff. *ovata*, Goldf., seems also to resemble it, but not so closely. Diener (13) has doubtfully recorded a species of *Myophoriopsis* under the name *M. krafftii* from the Kuling Shales of Spiti, but it is typically a Triassic genus (14). Frech (15) considers *Myophoriopsis* to be a subgenus of *Myophoria* with *M. lineata* as the type. Some varieties of *Myophoria laevigata*, Alberti, especially the variety *bronni* as figured by Rubenstrunk (19), possess much the same characters as our specimen, but the heavier and more incurved beak

in the latter is one of the distinctive features. Diener (20) has figured a shell as *M.*, aff. *lavigata*, from the Trias of Kashmir which differs from ours in the same way, though it has the carinal ridge. Our specimen (No. 11) bears a considerable resemblance to the shell from supposed Carboniferous beds on the Rio Agua Quente, Paraná, described by Holdhaus (16) as *Sanguinolites* (?) sp., but we may doubt if it is identical, and, at any rate, the generic reference to *Sanguinolites* cannot be maintained, *Schizodus* being more probable. It may be here mentioned that Girty (17) suggested that *M. krafftii*, Diener, might have affinities with *Schizodus securus*, Shumard, of the Guadelupian fauna, but the latter species is not like our shell. The Upper Carboniferous shell from Colorado figured by Girty (18) as *Sch. cuneatus*, Meek, differs also in the direction and position of the beak.

Myophoria (*Myophoriopsis*), aff. *carinata*, Bittner.
(Pl. I. figs. 6, 6 a, 6 b.)

A broken internal cast of a right valve (No. 21, pars) apparently belonging to another species of *Myophoriopsis* occurs in the collection. It has a more transversely elongated shape; the carination makes an acuter angle with the lower margin, has a slightly sigmoidal course, and does not form a narrow weak raised rib, but merely a sharp angulation of the surface; the posterior area is also longer and narrower. The whole shell seems more like *M. carinata*, Bittner (12 b) (21). The Triassic shell from the Jordan Valley, which Cox (22) figures as *Trapezium* sp., bears a considerable resemblance to our shell, and he compares his specimen with Assmann's (9 a) *Cypricardia* (*Trapezium*) *escheri*, Giebel.

Pachycardia neotropica, sp. n. (Pl. I. figs. 3, 3 a, 3 b.)

Shell transversely subtrigonal, narrowing posteriorly, nearly twice as long as high; anterior end subtruncate, broadly rounded; inferior margin long, gently arched; posterior end slightly produced, sharply rounded; cardinal edge straight or gently arched, oblique, extending about three-fourths the length of the shell; beaks subanterior, rather high and prominent, much swollen, directed forwards. Surface of valves convex, traversed by oblique groove, which becomes wider and shallower towards lower margin, which it meets behind the middle at an acute angle, dividing each valve into a depressed, gently convex, triangular anterior portion

and a muchswollen, elevated, rounded posterior lobe, abruptly descending to the cardinal edge; a narrow elongate lanceolate indistinctly defined posterior lunule extends behind the beak to the end of the hinge-line. Interior with small, subpyriform, deeply sunk, submarginal anterior muscle-scar, with a buttress behind it; posterior muscle-scar larger but faintly impressed and situated near end of hinge-line; pallial line strongly marked, curving rather obliquely upwards behind and not concentric to lower edge of valve, with a rather sudden upward bend and a slight convexity forwards on crossing the posterior convex lobe of the valve. Hinge-plate subumbonal, thick, massive, broad, bearing in left valve a large, stout, triangular cardinal tooth above with one or two smaller transverse teeth below it, and in the right valve two or three rather less stout cardinal teeth; posterior lateral tooth obscure, weak, thin, narrow, elongated. Surface of shell unknown.

Dimensions, No. 17 (left valve).—Length 24 mm.; height 15 mm.

Left valves Nos. 17, 22, 13.

Right valves Nos. 11, 16, 19, 21, 15.

Remarks.—The best-preserved specimen is an internal cast (No. 17) of a left valve, which has the dentition nearly perfect. Another internal cast of a left valve (No. 22) is nearly as complete, except in respect of the teeth. The right valves are very imperfect. It seems that this shell is allied to *Pachycardia rugosa*, Hauer, or to one of its varieties as figured by Waagen (4a), but the characters of the massive hinge-plate at first suggested that it might be referred to *Pleurophorus* or to one of the subgenera of *Megalodus*. Possibly it belongs to a new subgenus or even genus, for the course of the pallial line seems to be peculiar. We may call attention to its many points of resemblance to some species of *Durga*, Boehm (23), which seems almost inseparable from *Pachymegalodus*, Gümbel (24).

Megalodus, cf. *triqueter* (Wulfen).

One poor and imperfect internal cost (No. 20) of a left valve shows the anterior part and hinge, but the posterior end of the shell is broken off. A thick, broad, massive, semi-circular hinge-plate lies below the broad, low, incurved prosogyrous beak, and a short, deep, median, transverse groove separates incompletely two broad rounded teeth. The shell itself appears to have had a transversely rounded subtriangular shape; the anterior end is strongly rounded; the

inferior margin is nearly straight; the dorsal margin seems to have been strongly arched. The valve is somewhat flattened on the side. The beak is rounded, low, broad, and incurved. A large, oval, imperfect muscle-scar weakly impressed lies below the hinge-plate, and a submarginal strongly marked pallial line runs nearly concentric to the lower margin. From the general characters of this poorly preserved specimen, and especially from those of the hinge-plate and umbonal region, we may certainly refer it to *Megalodus*, and probably compare it with *M. triqueter*, Wulf. (25), or one of its varieties or allied species which Frech puts in the subgenus *Neomegalodus*, Gümbel (10a).

Dimensions.—Height at beak 15 mm.; length 19 mm.

Lucina paranaensis, sp. n. (Pl. I. figs. 4, 5.)

Shell transversely oval, subequilateral, longer than high; valves gently convex, somewhat compressed. Anterior end rather more broadly rounded than posterior end; inferior margin strongly arched; beak small, low, nearly central, slightly elevated and causing slight angulation in curvature of dorsal margin; pre-umbonal margin rather longer, gently arched. Interior of right valve with large, rather strongly impressed, anterior muscle-scar situated close to margin; posterior muscle-scar smaller, less strongly marked, suboval, marginal. Dentition of right valve composed of one short, stout, rounded, subtriangular cardinal tooth and a long, narrow, laminar, posterior lateral tooth extending to end of hinge-line. Surface of shell marked with concentric growth-lines of rather unequal strength.

Dimensions.—Height 13 mm.; length 17 mm.

Remarks.—There is only one right valve of this species in the collection, but fortunately its external impression and internal cast are both preserved, and the latter is perfect, showing the cardinal region and teeth quite distinctly. On the strength of the internal characters we must refer it to the genus *Lucina*, but it seems also to resemble certain species of *Gonodon*, such as *G. planum* (Münst.) (26), *G. schafhäutli*, Salomon (26a), and especially *G. (Schafhäuthia) astartiforme* (Münst.) (4b) (27), all of which occur in the European Trias, though it can hardly be identified with any one of them. We may also call attention to its resemblance to a species of *Loripes* (*L. atavus*, Waag.) (28) from the Productus Limestone of the Salt Range, but our shell is more transverse and less subcircular in shape, though the dentition seems to be similar.

Modiola (*Septiola*), cf. *dreysseensis*, Waagen.
(Pl. I. fig. 10.)

There is one specimen (No. 12) of an elongated sub-carinate mytiliform shell partly buried in the sandstone matrix which has the general characters of the shell from the Pachycardia beds figured by Broili as *Modiola* (*Septiola*) *subcarinata*, Bittner, var. *carinata*, Broili (3a). But it also resembles to a less extent the allied *M. alpina*, Gümbel, figured by Wöhrmann (14a) from the Cardita beds. We may more especially compare *M. (Septiola) dreysseensis*, Waag. (4c), from the Pachycardia beds of the Seiser Alm, and *M. (Septiola) nachamensis*, Mansuy (7b), from the Trias of Tonkin. The length of our specimen is about 14 mm.

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EXPLANATION OF PLATE I.

- Fig. 1. *Pachycardia*, aff. *rugosa*, Hauer, $\times 2$. Horizon 1.
- Fig. 2. *Myophoria* (*Myophoriopsis*), aff. *lineata*, Münster, $\times 1\frac{1}{2}$. Internal cast. Horizon 2.
- Fig. 3. *Pachycardia neotropica*, sp. n., $\times 2$. Internal cast of left valve. Horizon 2.
- Fig. 3 a. Ditto. Anterior view of same specimen, $\times 2$.
- Fig. 3 b. Ditto. Cardinal view of same specimen, $\times 2$.
- Fig. 4. *Lucina paranaensis*, sp. n., $\times 2$. Internal cast. Horizon 2.
- Fig. 5. Ditto. External impression of shell of same specimen, $\times 2$.
- Fig. 6. *Myophoria* (*Myophoriopsis*), aff. *carinata*, Bittner, $\times 1\frac{1}{2}$. Internal cast. Horizon 2.
- Fig. 6 a. Ditto. Cardinal view of same specimen, $\times 1\frac{1}{2}$.
- Fig. 6 b. Ditto. Inner view of same specimen, $\times 1\frac{1}{2}$.
- Fig. 7. *Anodontophora*, aff. *trapezoidalis*, Mansuy, $\times 1\frac{1}{2}$. Horizon 1.
- Fig. 8. Ditto. Interior of another specimen, $\times 1\frac{1}{2}$. Horizon 1.
- Fig. 9. *Trigonodus* sp., $\times 1\frac{1}{2}$. Internal cast. Horizon 1.
- Fig. 10. *Modiola* (*Septiola*), cf. *dreyssensiformis*, Waagen, $\times 1\frac{1}{2}$. Horizon 2.

All the above specimens are from the upper part of the Estrada Nova beds of Rio Claro, State of Paraná, Brazil.

III.—*Pseudamphimeryx hantonensis*, *sp. n.*, with Notes on certain Species of *Artiodactyls* from the Eocene Deposits of Hordwell. By C. FORSTER COOPER, M.A., Superintendent of the University Museum of Zoology, Cambridge.

[Plates II.-IV.]

Pseudamphimeryx hantonensis.

In a collection of fragments of vertebrates from the Upper Eocene of Hordwell in Hampshire collected by Mr. Lennie Aim*, which he has kindly sent to me for examination, are two right upper molars of a new species of *Pseudamphimeryx* † (Pl. IV. figs. 1-4).

This genus was founded by Stehlin ‡ for certain forms which can be distinguished from the allied genus *Amphimeryx* by the protocone, amongst other characters, being an incomplete, instead of a complete, crescent (the anterior horn of the crescent being absent), and by the presence of a well-marked cingulum in front of the protocone.

The two teeth found by Mr. Aim agree with these particulars, but differ in one point from Stehlin's description and figures § in that they present at first sight the appearance of having six cusps. In the position where the hypocone should normally occur in a six-cusped tooth there is a distinct and well-formed cusplet which in the more worn of the two molars forms a half-crescent. This cusp, however, cannot be regarded as a true hypocone such as is found in the very different-looking molar of *Dichobune* as it runs into the posterior horn of the crescentic protocone || (text-fig. 1).

* Mr. Aim is paying great attention to this fauna. The specimens seem unfortunately to be, as a rule, in a very fragmentary condition, and are scarce and difficult to find. There are scattered teeth and fragments of bone of small Primates and other small mammals which are at all events new to this fauna. It is to be hoped that in time Mr. Aim will be able to secure more complete material for description.

† As in this country the material of the Eocene mammals of Europe for comparison with the British forms is almost non-existent, I took the opportunity of consulting my friend Dr. Stehlin, who very kindly gave me information on this genus as well as on the specimen here described as *Chæropotamus depereti*.

‡ Abh. der Schweiz. Pal. Gesell. vol. xxxvi. pp. 982-1010.

§ Loc. cit.

|| Although this feature is not shown in any of Stehlin's figures, Dr. Stehlin informs me that it is a variable feature in his specimens of the genus. In the present case the development seems to have reached a maximum.

Both molars have a very pronounced protostyle and mesostyle, and the two external and two intermediate cusps are strongly crescentic.

In size these specimens are considerably larger than the

Text-fig. 1.



Pseudamphimeryx hantonensis.

Diagram of the arrangement of cusps of the upper molar, much enlarged.

other known species and may be described as new. This genus is recorded from Hordwell for the first time. A fragment of jaw with a broken third molar is referred to this species (Pl. IV. fig. 4).

Note on Haplobunodon lydekkeri (Stehlin).

This species, at one time known as *Anthracotherium gresslyi* (Lydekker), has been described by Stehlin*, who remarks, however, that certain points of the pattern of the teeth cannot be made out from the scanty original description or from the original figures. A convenient opportunity now presents itself to remove this cause of complaint by giving photographic illustrations† of the type-specimen, which it is hoped will render all but the following brief description unnecessary.

Of the upper teeth (Pl. II. fig. 1) the third molars are but little worn and show the true condition of the cusps. These are bunodont, and such small height as they rise to can be seen in the figure (Pl. III. fig. 1), which shows them in side view. Until rather well worn down (as in the second and, still more, the first molars) there is but little of the

* Stehlin, *loc. cit.* vol. xxxv. p. 752, where a full account of the history of the synonymy of this species is given.

† For the preparation of the figures of this species I am indebted to Mr. A. T. Hopwood of the British Museum.

selenodont condition, and then only in the inner cusps, the protocone and metaconule. The outer cusps, the protocone and metacone, hardly become selenodont at all, and the mesostyle is only a very small cusplet rising from the cingulum, and is connected with the paracone and metacone by very low walls. Neither the mesostyle nor parastyle project outwards, which is a reason for the absence of the selenodont pattern. The cingulum is very slight. All the upper molars are distinctly broader in front than behind. Of the premolars, proceeding from behind forwards, the fourth has a single high cusp on the outside and a low one on the inside, the two lying on a base which is an equilateral triangle. A cingulum is present all round, except on the posterior part of the outer border.

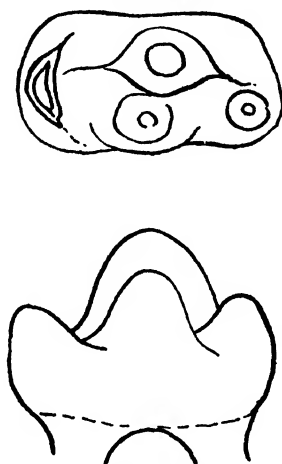
The third is much like the first, but no internal cusp rises from the cingulum. The second is simple, single-cusped, and somewhat elongate in base-plan. As to the first premolar the situation is a little doubtful. In the actual specimen a hole has at some period been excavated close to the second premolar, and this looks like a socket for a tooth. The other side is incomplete, but, as far as it goes, does not support the view that the hole is a true socket which may have been a trial pit made in search for a tooth-root. In front of the second premolar there is a long diastema and then a small, rather damaged, tooth supported on a strong curved root, which is apparently formed either of two closely adpressed roots or else a single grooved one. It is certainly caniniform and, by reference to the lower jaw, it would bite behind the corresponding tooth (which is represented in the lower jaw by a socket).

It is, of course, an assumption, but if we assume for the present that the elongated snout of this animal was arranged in the same way as that of the later genus *Ancodon* (to which, of course, it is not all closely related), then the teeth in question are canines and not caniniform premolars. In species of *Ancodon** it is common to find the three incisors and canine, the latter often with curved and grooved roots, all closely pressed together in the front of the jaws. Then after a diastema of variable length a solitary socket obviously for the first premolar, then another diastema followed by the rest of the tooth-series. In *H. lydekkeri* the diastema between the second premolar and the tooth in front is in good condition enough to warrant the statement that there was no

* Forster Cooper, Ann. & Mag. Nat. Hist. ser. 9, vol. xvi. pp. 118 et seq. (1925).

tooth in that part, and good enough in the upper jaw to support the view that there was not one in the upper jaw. Moreover, if this tooth is really a premolar there would hardly be room for the canine and incisors without making the snout disproportionally long. In my own view Lydekker's original description of these anterior teeth as canines is supported, and Stehlin's tentative suggestion that they are caniniform premolars* is the less supported by the actual specimen. It appears, then, to be likely that this animal was without the first premolars in the upper and lower jaws.

Text-fig. 2.

*Haplobunodon lydekkeri.*

Enlarged diagrams showing the cusp arrangement of the left fourth lower premolar. The posterior end of the tooth is on the left of the figure. The lower figure is viewed from the inner side.

Of the teeth of the lower jaws the third molar has a broad flat talon and, in common with the other two molars, has no cingulum except a small cusp on the outer side in the valley between the two cross-ridges. The external cusps are practically round and the internal only just crescentic, and then only when somewhat worn. The anterior horn is more pronounced than the posterior. All the cusps are low.

The fourth premolar, as is well known, is a very distinctive tooth, which differs entirely from that of *Anthracothers*.

* Stehlin, it must be remembered, had only the woodcut figures to rely upon, and his suggestion is even now not absolutely ruled out.

As Lydekker's figure (B.M. Cat. part 11, fig. 36) does not bring out its structure very clearly, it is here figured diagrammatically (text-fig. 2) as well as in the Plate (Pl. III. fig. 2). There are three main conical cusps forming an anterior triangle, which is followed by a low but well-marked talon, on the centre of which at the posterior edge is a crescentic cusp. Of the triangle of cusps the outer cusp is the highest and sends a ridge forwards and towards the anterior inner cusp, which, however, it does not reach; a low ridge also runs posteriorly towards the talon. The anterior cusp is the smallest and is quite low; the posterior inner cusp is intermediate in size.

The third and second premolars are single cusps with a talon decreasing in size. In front is a diastema of 2 centimetres without trace of tooth-sockets until a tooth-root appears which is presumed to be the canine. The symphysis of the jaws runs forward from the level of the front of the second premolar for a distance of $2\frac{1}{2}$ centimetres. The incisors are unknown.

Depéret's * withdrawal of this form from any close connection with the *Anthracothers* is correct beyond doubt. Further evidence for this is now at hand from Miss Pearson's † investigation of the basicranium and ear-region. The illustration of this region given in this paper (Pl. II. fig. 1) can be elucidated by reference to Miss Pearson's paper.

The two teeth from the Bembridge beds of the Isle of Wight, an upper and lower molar, mentioned by Lydekker as belonging to "*Anthracotherium gresslyi*" (B.M. Cat. No. 37333), do not appear to belong to this species. The upper molar differs in being considerably smaller in size and rectangular in shape instead of trapezoidal, the metacone is somewhat damaged, but enough remains to show that the hind part of the tooth was as broad as the front (Pl. III. figs. 5, 7).

The lower molar, either a first or second, is rather too worn to show any characters, but both teeth may provisionally be placed in the genus *Haplobunodon* (Pl. III. figs. 6, 7).

The fragment of a lower jaw, also mentioned by Lydekker as an *Anthracotherium* (B.M. Cat. No. 29856), differs from *H. lydekkeri* in several points (Pl. III. figs. 3 & 4). It is larger and deeper and the contour of the lower border of the jaw from M2 to some distance behind M3 is straight instead of

* C. R. 1908, *Haplobunodon picteti*.

† T. R. S. no. B 429, p. 439, text-figs. 38 & 39 in particular.

being distinctly curved. The external cusps of the molars are much more strongly V-shaped than is the case in *Haplobunodon*, and the anterior horn of the postero-internal cusp runs right across the valley to the antero-internal cusp. The internal cusps, instead of being round, are more ridged. The talonid of the third molar is somewhat compressed and runs obliquely forward to the inner side, and shows, in this almost unworn tooth, a flat cusp on the external and a small thickening on the internal side. There is on the outer edge a small shelf of cingulum between the talonid and the cusp in front of it, which occurs again between the two external cusps.

Without any anterior teeth it is not possible to state the genus of this specimen with any certainty. It has, however, the appearance of a species of *Catodontherium*, in which genus it may provisionally be placed.

Chæropotamus depereti (Stehlin).

This species is also new to the Hordwell fauna. The specimen * (Pl. IV. fig. 8) (B.M. No. 29736, not mentioned by Lydekker) is a somewhat crushed lower jaw with the first and second molars. It agrees closely with the figures given by Depéret †.

Anthracotheroid incertæ sedis.

In the collection of Hordwell mammals in the Sedgwick Museum at Cambridge there is a fragment of a lower jaw containing the second molar and the anterior two-thirds of the last molar. This specimen (Pl. IV. figs. 5 & 6) is of some interest in being, with one exception, the largest form of *Anthracotheroid* that has so far been found in the Hordwell deposits or in any of the European deposits of equal age. The one exception is the celebrated *Diplopus*, an animal, as large as the large *Ancodons* of the later Oligocene times, whose skeleton is almost completely known except for the skull and dentition. In general skeletal characters *Diplopus* shows much in common with the genera *Ancodon* and *Brachyodus*, and its dentition may be expected to prove to be like that of the latter genus. In the present specimen the third molar is somewhat damaged, but the second is well enough preserved to show that it closely resembles

* Wrongly named *Anthracotherium minus* by me in Ann. & Mag. Nat. Hist. ser. 9, vol. xviii. p. 373, note (1926).

† Depéret, "Monographie de la faune de Mammifères fossiles de Ludien Inférieur d'Euzet-les-Bains," Ann. de l'Univ. de Lyon, i. 40, 1917, pl. xvi.

the corresponding tooth of a *Brachyodus* of the size of *B. porcinus*, except that the cusps may perhaps be rather lower. Apart from considerations of the geological horizon there would be little hesitation in placing the specimen in that genus. *Brachyodus*, however, is not known in such early formations as that of Hordwell. The specimen perhaps may represent a small example of *Diplopus*, and with it may be mentioned a second upper milk-tooth (Pl. IV. fig. 7), also from an Anthracotheroid of fairly large size.

EXPLANATION OF THE PLATES.

PLATE II.

- Fig. 1. *Haplobunodon lydekkeri*, the type-specimen. Palate.
Fig. 2. Ditto. The lower jaws lying in matrix.

PLATE III.

- Fig. 1. *Haplobunodon lydekkeri*, the type-specimen. Skull and upper dentition in side view.
Fig. 2. Ditto. Lower jaw in matrix, surface view of teeth.
Fig. 3. *Catodonthrium* sp. Side view.
Fig. 4. Ditto. Surface of teeth.
Fig. 5. *Haplobunodon* sp. Upper molar, enlarged.
Fig. 6. Ditto. Lower molar, enlarged.
Fig. 7. Figures 5 & 6 the natural size.

All figures except No. 7 are natural size.

PLATE IV.

- Figs. 1 & 2. *Pseudamphimerus hantonensis*, sp. n. Upper molars, enlarged. Figure 2 is the type-specimen.
Fig. 3. The same, natural size.
Fig. 4. Damaged lower third molar attributed to the same species, enlarged.
Figs. 5-6. Side and surface view of second and damaged third lower molar of an Anthracothere, natural size.
Fig. 7. Upper milk-tooth of an Anthracothere, natural size.
Fig. 8. *Charopotamus depereti*. Lower jaw, natural size.

IV.—*Apterygota from the New Hebrides.*

By H. WOMERSLEY, F.E.S.

[Plates V. & VI.]

FOR the opportunity of examining and describing the following species of Apterygota I am greatly indebted to Dr. J. R. Baker of Oxford. The specimens comprised a small collection made by Dr. Baker while on a collecting expedition to the New Hebrides in 1927, which expedition

was partly financed by the Trustees of the Percy Sladen Fund.

The collection was somewhat small in the number of species as well as individuals. All the species are, however, new to science, and the single Thysanuran (a Lepismid) is of considerable interest, as it requires a new genus coming between the well-known genera *Ctenolepisma*, Escherich, and *Thermobia*, Chittenden. For the new genus I propose *Bakerella*, after Dr. Baker, and for the species *andersonæ* after the wife of the missionary who assisted Dr. Baker in collecting these insects.

All the other species belong to the Collembola and are all members of the genus *Lepidocyrtus*, Bourl., and its ally *Pseudosira*, Schött. Although these species are different from any yet described, they show a very definite relationship with the forms described from the Bismarck Archipelago by Schäffer, 1898.

The species and number of specimens are :—

THYSANURA.

Bakerella andersonæ, gen. et sp. n.

COLLEMBOLA.

Pseudosira flavescens, sp. n.

Lepidocyrtus pseudopictus, sp. n.

: „ *medioides*, sp. n.

„ ? sp. indet.

THYSANURA.

Family *Lepismidæ*.

Genus *BAKERELLA*, nov.

Allied to the genus *Ctenolepisma*, Escherich, but differs in that the dorsal “setal combs” are not present on the thoracic tergites. It is further intermediate between *Ctenolepisma* and *Thermobia* in having only a single pair of dorsal posterior sublateral “setal combs” on abdominal tergites ii. to viii. with, in addition, a submedial posterior pair on tergite iv. The lateral combs on thoracic tergites number ten to twelve. Posterior lateral combs are present on abdominal tergites ii. to viii. The mandible just below the toothed apex is finely “figured” in a scale-like manner, but whether this character is of generic value remains to be seen.

Bakerella andersonæ, sp. n. (Pl. V. figs. 1–5.)

Colour when scaled uniformly brown, denuded of scales whitish yellow.

Body-length 7 mm., thorax 2 mm., not much wider than the basal abdominal segments (Pl. V. fig. 1).

Head between antennæ and between the antennæ and the eyes heavily fringed with strong feathered setæ, some of which are bifid at the tip.

Antennæ, unscaled except on two basal joints, about half the length of body. Max. palpi five-jointed, the joints respectively 3 : 6 : 8 : 7 : 6½, lacinia shorter than galea. Mandible with four strong but blunt teeth and with a well-developed molar area; below the teeth of the mandible the surface is finely "figured" in a scale-like manner (fig. 2). Labial palpi four-jointed (fig. 4), the terminal joint with six papillæ in a single row. Each papilla is on a short peduncle and is itself papillose. On the inner edge of the terminal joint are several erect sensory clubs (fig. 4).

Thoracic tergites with from ten to twelve lateral setal combs on each side, and these usually with only three to five setæ in each. Dorsal combs absent. Legs armed with strong spines and a few feathered setæ. On the inner side of the femora are three of the latter. Empodium about half the length of the lateral claws.

Abdominal tergites ii. to viii. with posterior lateral combs and a pair of posterior sublateral combs. Tergite iv. has a posterior submedial pair in addition. Tenth abdominal tergite as in *Ctenolepisma*. Styles present on segments viii. and ix., the latter twice the length of the former. Penis short, just reaching the tip of ninth subcoxae. Medial process of cerci half the length of body, lateral processes a little shorter.

Described from two male specimens (one sacrificed for dissection) taken in the Missionary's linen cupboard, Hog Harbour, Santo, New Hebrides, April 5th, 1927.

Type. In the Hope Museum, Oxford.

COLLEMBOLA.

Suborder ARTHROPLEONA, Börner.

Family Entomobryidæ, v. Dalla Torre.

Subfamily ENTOMOBRYINÆ, Schöff., Börn.

Tribe ENTOMOBRYINI, Börn.

Genus PSEUDOSIRA, Schött.

Pseudosira flavescens, sp. n. (Pl. VI. figs. 12-14.)

Colour (in alcohol) light yellow with a black dot between antennæ and a slight brownish tinge on head and on the sixth

abdominal segment. Antennæ yellow with a black tip on second and third segments, fourth segment brownish. Legs and furca yellowish.

Eyes eight on each side on a black patch.

Antennæ about three-quarters length of body, first two joints at least with scales. Relative lengths of joints 6:7:7:11, joints thickly clothed with unciliated hairs, 2 and 3 with two or three outstanding ciliated setæ, fourth joint unannulated and with apical sense-knob.

Legs with a strong clavate tibial tenent hair, joints with numerous hairs, most of which are finely ciliated, and a number of ciliated setæ. Claws similar on all feet. Unguis long and narrow with a strong outer basal tooth and two inner teeth nearer to each other than the distal one is to the apex. Unguiculus rather more than three-quarters the length of unguis, untoothed.

Furca almost two-thirds the length of body—manubrium : mucrodens : 4:7,—unannulated portion of dens one and a half times the length of mucro, dens scaled ventrally. Dens and manubrium with strong finely ciliated hairs. Mucro of medium size, only separated from dens ventrally, with only a blunt moderately curved apical tooth and without basal spine.

Abdominal segment iv. three and a half times the length of segment iii.

Clothing consists of numerous fine hairs and a number of strong finely ciliated setæ. On the head, on the mesonotum, and on segment vi. of the abdomen these setæ are clubbed and bent and with the cilia only at the end, while on the mesonotum they form a very distinct deflected collar.

Size 2 mm.

Locality. 3 specimens on rain-water in canoe, Elephant Island, Santo, New Hebrides, May 19, 1927; 2 specimens on rain-water in canoe, Gaua, Santo, New Hebrides, June 8, 1927.

This species is apparently closely related to *P. indra*, Imms, and *P. evansi*, Brown.

Type and co-types in the Hope Museum, Oxford.

Genus *LEPIDOCYTUS*, Bourl.

Lepidocytus pseudopictus, sp. n. (Pl. VI. figs. 6–9.)

Colour (in alcohol) : head with bluish-black patches on sides leaving a clear whitish-yellow dorsal stripe, mesonotum which considerably overlaps head similarly dark at the sides

with a whitish dorsal longitudinal stripe, metanotum all dark, first abdominal segment all whitish yellow, second and third all dark, fourth light but flecked with a few dark scales for two-thirds of its length then becoming all dark, fifth all yellow, sixth with a few dark markings. Legs and furca yellowish becoming brownish on femora and manubrium. Antennal joints purplish brown at base becoming yellow at tip.

Scales typical of the genus.

Eyes eight on each side on a black patch.

Antennæ rather more than half the length of body, first two joints with scales, relative lengths of joints 7 : 10 : 9 : ?. First three segments (specimen damaged) thickly haired and with two or three strong ciliated setæ.

Legs with strong clavate hair, joints thickly covered with ciliated hairs, tibiæ with one or two strong outstanding setæ. Claws similar on all feet, unguis long and narrow with a strong outer basal tooth and three fine inner teeth, one almost at the tip, the others at equal distances apart, unguiculus lanceolate, three-quarters the length of unguis, and with a fine outer tooth about a quarter its length from base (fig. 9).

Furca long, reaching the second thoracic sternite, manubrium : mucrodens : 7 : 9, unannulated portion twice the length of dens. Dens and manubrium with numerous finely ciliated hairs. Mucro of moderate size, with a strong, slightly curved, apical tooth and an equally strong medial tooth with straight inner edge, and a basal spine. Mucro distinctly separated from dens.

Abdominal segment iv. five times the length of segment iii.

Length of insect 2.5 mm.

Locality. A single specimen taken on table in tent at Hog Harbour, Santo, New Hebrides, March 30th, 1927.

Type. In the Hope Museum, Oxford.

This species is very closely allied to *L. pictus*, Schäffer, 1898, from the Bismarck Archipelago. In coloration it may be distinguished by the larger amount of colouring on the sides of the head and the completely dark metathorax, which in Schäffer's species is colourless. The fifth abdominal segment in *pseudopictus* is colourless in contrast to the dark segment in *pictus*. The claws are similar in both species, but the mucronal teeth in *pseudopictus* are decidedly recurved and very distinct from those of *pictus*.

Lepidocyttus medioides, sp. n. (Pl. VI. figs. 10–11.)

Colour (in alcohol) uniformly yellowish except for the

black eye-patch, a small black dot between the antennæ, and a very faint line joining this spot to the eye-patches. Antennæ (first two joints only) yellowish with a violet suffusion near the tips.

Eyes eight on each side.

Antennal joints 3 : 4 : ? : ?, covered with ciliated hairs.

Head about as long as mesonotum, which apparently only slightly overhangs.

Legs with a long fine clavate hair and covered with strong ciliated hairs, outstanding setæ few if any, claws similar on all feet. Unguis lanceolate with strong but fine outer basal tooth and three fine inner teeth. Unguiculus only moderately broad, about three-fourths the length of unguis, obliquely truncate distally with slight suspicion of a tooth at inner angle, otherwise unarmed.

Furca half the length of body excluding head, manubrium : mucro : dens : 4 : 5, both manubrium and dens covered with scales and finely ciliated hairs to base of mucro, dorsally and ventrally the mucro is distinctly separated from dens. The mucro has a blunt curved apical tooth and a similar tooth one-third from apex and a stout basal spine. Dens annulated to base of mucro.

Abdominal segment iv. about three times the length of segment iii. A number of ciliated setæ at end of abdomen are slightly clubbed.

Length 1.3 mm.

Locality. Hog Harbour, Santo, New Hebrides, January 28, 1927. A single specimen from water lying in an opened coconut.

Type. In the Hope Museum, Oxford.

This solitary specimen was in poor condition, and consequently not altogether satisfactory for determination. In colour and details it comes very near to *L. medius*, Schüffer, from the Bismarck Archipelago, but differs apart from its rather larger size in having three strong inner teeth to the upper claw and a fine one at the inner angle of the lower claw. It also shows considerable relationship to *Lepidocyrtoides angulatus*, Schött., from North Queensland, but whether it belongs to the subgenus *Lepidocyrtoides* is indeterminable.

Lepidocyrtus sp. indet.

A single specimen in very poor condition, impossible to determine, taken in camp, Santo, New Hebrides, February 24, 1927.

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EXPLANATION OF THE PLATES.

PLATE V.

Thysanura.

- Fig.* 1. *Bakerella andersonæ*, gen. et sp. n.
- Fig.* 2. Ditto. Tip of mandible.
- Fig.* 3. Ditto. Tip of lacinia.
- Fig.* 4. Ditto. Labial palp.
- Fig.* 5. Ditto. Edge of labial palp (terminal joint) showing sensillæ.

PLATE VI.

Collembola.

- Fig.* 6. *Lepidocyrtus pseudopictus*, sp. n.
- Fig.* 7. Ditto. Scale.
- Fig.* 8. Ditto. Mucro and tip of dens.
- Fig.* 9. Ditto. Foot.
- Fig.* 10. *Lepidocyrtus medioides*, sp. n. Mucro and tip of dens.
- Fig.* 11. Ditto. Foot.
- Fig.* 12. *Pseudosira flavescens*, sp. n. Mucro and tip of dens.
- Fig.* 13. Ditto. Foot.
- Fig.* 14. Ditto. Thoracic seta.

V.—*Some Records of Apterygota from Lundy Island, Devonshire, with the Description of a new Species of Entomobrya (Collembola).* By H. WOMERSLEY, F.E.S.

[Plate VII.]

DURING a holiday at Ilfracombe the opportunity of a few hours on Lundy Island was used to make a preliminary investigation of the Apterygota of the island. Amongst the few species obtained was an interesting form of *Entomobrya* not previously described.

The list of species is as follows :—

Order THYSANURA.

Family Machilidæ.

Genus PETROBIUS, Latreille.

Petrobius carpenteri, Bagnall.

— *silvestri**, Womersley.

Order COLLEMBOLA.

Oncychiurus armatus, Tullb.

Entomobrya nigrina, sp. n.

— —, var. *lundyense*, nov.

Isotoma viridis, Boul.

Orchesella cincta (L.), Lubk.

Allacma fusca, Linn.

Entomobrya nigrina, sp. n.

(Pl. VII. figs. 1, 3, 4, 5, & 6.)

Length 2.5–3.0 mm.

Head: ground-colour yellow, with eight eyes on each side on black patches (Pl. VII. fig. 6); a dark border of violet at base of antennæ, with a somewhat triangular mark in between; a lateral border on sides of head, broken opposite the posterior end of eye-patch; the back portion of this border does not go round the back of head, but is broadly expanded until it meets the end of the eye-patch.

Antennæ very variable in length, but always more than

* I did not observe this species myself, but specimens taken on Lundy in July 1927 were sent to me for determination by Mr. O. W. Richards.

half the body-length, and in some specimens reaching to three-quarters. Relative lengths of antennal joints:—1:2:1½:3. Colour deep violet, except at the extreme tips of first, second, and third joints and basal half of first, which are yellow.

Mesothorax about equal to head-diagonal in length; ground-colour yellow, with but little markings; posterior border little and indefinitely marked, lateral border distinct but anteriorly becoming indefinite and consisting then of a few spots.

Metathorax and abdominal segments 1 to 3 somewhat similar to each other in markings, posterior border fairly distinct and narrow on abdominal segment 3, but gradually becoming less distinct to metathorax; lateral borders broad, joining posterior and anterior edges of segments. On segment 3 of abdomen there is a ω -shaped infusion, which becomes less evident on the more anterior segments. Under a low power the general aspect of these segments is that of almost complete dark violet-brown relieved with a few light flecks.

Fourth abdominal segment with yellow ground-colour, a subposterior dark narrow band which sends forward two submedial intrusions for two-thirds of segment-length. These intrusions broaden out at the apex and become three-pronged, the open yellow space between them is about one-third of segment-width. A strong lateral border joins anterior and posterior edges of segment, and is broadened out medially, approaching but not joining the submedial intrusions.

Abdominal segment 5 with strong posterior markings broken in the medial line. Segment 6 with two posterior lateral spots.

Legs: femora yellow, with violet lateral streaks towards apex, tibio-tarsus strongly violet except at base and apex. Unguis (Pl. VII. fig. 3) broadly lanceolate, with an outer basal tooth, the inner edge with a paired basal tooth and two fine teeth near the apex but closer to each other than the distal one is to the tip of unguis. There are also traces of a lateral tooth. Tibio-tarsus with a strong clavate tenent-hair. Unguiculus with inner tooth and slightly truncate apically.

Furca whitish yellow, with lateral violet streaks on manubrium and at the immediate base of dens. Ratio of manubrium to mucrodens 3:4. Unannulated portion of dens one and a half times the length of mucro. Mucro about one-third the length of unguis. Mucro (Pl. VII. fig. 4) without basal spine.

Clothing of body consists of shortish depressed hairs,

together with a large number of finely ciliated clubbed setæ (Pl. VII. fig. 5). These are especially numerous around the neck.

Described from one of several specimens taken on the cliff-face at the landing-place on Lundy Island, 26. vii. 27. Others were taken in similar habitats at Rapparee Cove, Ilfracombe, 27. vii. 27, and at Combe Martin, 28. vii. 27. If not present on the face of the cliff these little creatures could be disturbed from amongst the organic matter in the crevices frequented by *Petrobii*.

Although the identification of species of the genus *Entomobrya* is a very difficult matter, as they are so much given to variation both in colour-markings and antennal length, yet I think we can consider this form as a definite and distinct species. It somewhat approaches *nivalis*, L., in decoration, but differs in that the submedial intrusions from the posterior edge of the fourth abdominal segment do not reach the anterior edge, are not Y-shaped, and are not continued through to the mesothorax. The antennæ of both *nivalis*, L., and *multifasciata*, Tullb., are largely yellow, only becoming slightly darker on the third and fourth joints. The legs of these two species are also yellow, with at the most only slight traces of marks at the tip of femora.

While the length of the antennæ would seem to be of little value, yet the ratio of the lengths of the different joints is useful. Joint 4 is longer in proportion to joint 3 in *nigrina* than in the other two species. In *nivalis* the unguis is not so broad and the second tooth on the inner edge is situated nearer the middle, while the unguiculus has no sign of an inner tooth. The mucro of *nivalis* has a basal spine absent in *nigrinus*. In our common species the mucro is only one-sixth the length of unguis, with an unannulated portion three times its length.

The markings also somewhat resemble those of *pulchra*, Schäffer, from South America, but this species possesses a basal spine to the mucro and has a much longer unannulated portion to the dens.

With the exception of *macrocerata*, Bagnall, it is larger than any other British species of this genus. From this species it differs in the relative lengths of antennal joints and the form of unguis.

Entomobrya nigrina, var. *lundyense*, nov.
(Pl. VII. fig. 2.)

This very dark form was found only on Lundy Island. It has rather longer antennæ, but differs chiefly in coloration.

The metathorax and first three abdominal segments are entirely dark except for slight flecks. On abdomen 4 the submedial intrusions are united to each other and also to the lateral borders at the apices and bases, leaving only narrow yellow spaces between. The yellow ground-colour on apical third of this segment is, however, very conspicuous.

EXPLANATION OF PLATE VII.

- Fig. 1. *Entomobrya nigrina*, sp. n., type.
 Fig. 2. *Entomobrya nigrina*, var. *lundyense*, nov.
 Fig. 3. *Entomobrya nigrina*, sp. n., type. Hind foot.
 Fig. 4. Ditto. Mucro.
 Fig. 5. Ditto. Ciliated clubbed seta.
 Fig. 6. Ditto. Eye-patch.

VI.—European Species of Notonecta.

By TEISO ESAKI.

FOLLOWING Linné's (1758) description of *Notonecta glauca*, L., the only Linnean species of *Notonecta* in the modern taxonomical sense, several species had already been added to the European fauna by the end of the eighteenth century. Besides the very distinct species, *Notonecta lutea*, described by Müller in 1776, Fabricius added three more species of the *glauca*-group, occurring in Europe and the palæarctic part of Africa, in 1794 and 1803. These were *Notonecta furcata*, Fabricius, *N. marmorea*, Fabricius, and *N. maculata*, Fabricius. Later authors have treated these species in different ways—in fact, several authors such as Burmeister, Fieber, Kirkaldy, etc., have treated these three forms as varieties of *Notonecta glauca*, Linné. Owing to the more accurate investigations of subsequent workers, however, *Notonecta furcata*, Fabricius, and *N. maculata*, Fabricius, have now been proved to be quite distinct specifically from *Notonecta glauca*, Linné; but *Notonecta marmorea*, Fabricius, is apparently still regarded by many authors either as a variety of *N. glauca*, Linné, or as a synonym of *Notonecta maculata*, Fabricius. Later on another species occurring in France and other places was separated by Delcourt (1909) from the *glauca*-group under the name *Notonecta viridis*, Delcourt. Still later the same species was described from England by Edwards (1918) as *Notonecta halophila*, Edwards, of which identity with *Notonecta viridis*, Delcourt, was reported by Poisson (1925). The very wide distribution

of this species has since then been established by several authors, and recently the Mediterranean type, differing from the Channel type both in coloration and biologically, was separated by Hutchinson (1927) as subspecies *mediterranea*, Hutchinson (1928) (new name for *meridionalis*, Hutchinson, 1927, nom. præocc.). Quite recently another new *Notonecta* was described from Spain and North Africa by Poisson (1926) and by the present writer (1927) independently within a short interval under the names *Notonecta pallidula*, Poisson, and *Notonecta horváthi*, Esaki, respectively.

Of these forms, *Notonecta viridis*, Delcourt, and its subspecies *mediterranea*, Hutchinson, are most remarkable in various respects. These forms, in spite of their general resemblance with other species of the genus, are at once distinguished by the acute anterior lateral angles of the pronotum. Both the forms—i. e., *viridis*, Delcourt, and *mediterranea*, Hutchinson—are very different in coloration and also biologically. The former has so far been found only from North-Western France, England, and Holland. In England and Holland (1*) it is found exclusively in brackish water near the sea-shore, while in France this may be also the case, although I have at present no verification of it (2). The latter is found in fresh water and is widely distributed. So far as I am aware, it is found in Southern France, Italy, Sicily, Hungary, Greece, Algeria, Asia Minor, Cyprus, Palestine, Crimea, Transcaspia, Persia, and North India (3)—in fact, it is not at all rare in Southern Europe. Although I have examined very precisely the various structures, especially that of the male genital apparatus of both the forms in several specimens from different localities, I have failed to find any difference which can be regarded as more than individual variation. On the other hand, I have studied the descriptions of the *Notonecta* species by the classic authors with the suspicion that the common *Notonecta viridis mediterranea*, Hutchinson, might have been described previously, and that the synonymies given in the dogmatic “revision” of the Notonectidæ by Kirkaldy (1897) (4) might not be quite correct. As a result of my investigations some changes in nomenclature of the European and North African species of *Notonecta* apparently become necessary. The following synonymies have been established by the careful study of the original works of the authors :—

* Clarendon figures in parentheses refer to the Notes on pp. 71-76.

1. *Notonecta glauca*, Linné (5), 1758.

1758. *glauca*, Linné, Syst. Nat. ed. x. p. 439.
 1766. *prima*, Schäffer (6), Icon. Ins. Ratisb. i. pt. 1, tab. xxxiii. figs. 5, 6, nom. invalid. et nudum.
 1773. *notonecta* (De Geer), Nepa, Mém. Hist. Ins. iii. p. 382, tab. xviii. figs. 16-28.
 1778. *glauca*, Goeze, Ent. Beytr. ii. p. 166.
 1789. *glauca*, Gmelin, Syst. Nat. (Linné), ed. xiii. p. 2118.
 1794. *glauca*, Fabricius, Ent. Syst. iv. p. 57.
 1803. *glauca*, Fabricius, Syst. Rhyng. p. 102.
 1804. *glauca*, Panzer, Schäfferi Icon. Ins. Ratisbon., Enum. Syst. i. p. 48.
 1817. *glauca*, Leach, Trans. Linn. Soc. London, xii. pt. i. p. 13.
 1829. *glauca*, Fallén, Hem. Svec. p. 177.
 1835. *glauca*, Burmeister, Handb. Ent. ii. p. 190.
 1837. *glauca*, Herrich-Schäffer, Nomencl. Ent. i. p. 63.
 1840. *glauca*, Spinola, Essai Ins. Hem. p. 59.
 1840. *glauca*, Blanchard, Hist. Nat. Ins. iii. p. 88, tab. Hémi. i. fig. 2.
 1843. *glauca*, Amyot et Serville, Hémi. p. 452.
 1845 (7). *glauca*, Herrich-Schäffer, Wanz. Ins. viii. p. 23.
 1848. *Notonecta*, var. *glauca*, Amyot, Ent. Franc., Rhynch. p. 337, tab. iii. fig. 54, nom. invalidum.
 1851. *fabricii*, var. *glauca*, Fieber (8), Abh. Böhm. Gesel. Wis. (5) vii. p. 474.
 1860. *glauca*, Flor, Rhynch. Livl. i. p. 772.
 1861. *fabricii*, var. *glauca*, Fieber, Eur. Hem. p. 101.
 1865. *glauca*, Douglas et Scott, Brit. Hem. i. p. 587, tab. xx. fig. 4.
 1878. *glauca*, Snellen van Vollenhoven, Hem. Heter. Neerland. p. 347, tab. xx. figs. 2, 2a.
 1880. *glauca*, var. *glauca*, Puton, Synop. Hémi. Hétér. France, iii. p. 217.
 1892. *glauca*, Saunders, Hem. Heter. Brit. Is. p. 329.
 1897. *glauca*, var. *glauca*, Kirkaldy, Trans. Ent. Soc. London, 1897, p. 421.
 1905. *glauca*, Hueber, Jahresh. Ver. Vaterl. Naturk. Wurttemberg, lxi. p. 113.
 1909. *glauca*, Oshanin, Verz. Palae. Hem. i. p. 974.
 1909. *glauca*, Kuhlitz, Süßwasserf. Deutschl. (Brauer), vii. p. 79, fig. 68.
 1912. *glauca*, Jensen-Haarup, Danmarks Fauna, xii. (Taeger), p. 31, fig. 10.
 1923. *glauca*, Butler, Biol. Brit. Hem. Heter. pp. 558, 559.
 1925. *glauca*, Poisson, Bull. Soc. Ent. France, p. 328, fig. 2.

2 a. *Notonecta marmorea marmorea*, Fabricius (9), 1803
(= *mediterranea*, Hutchinson).

1803. *marmorea*, Fabricius, Syst. Rhyng. p. 103.
 1835. *glauca*, var. β , Burmeister, Handb. Ent. ii. p. 190.
 1840. φ *marmorata* (1), Spinola, *vide* Fabricius, Essai Ins. Hem. p. 59.
 1840. *glauca*, var. *maculata*, Blanchard, Hist. Nat. Ins. iii. p. 89.
 1843. *glauca*, var. *marmorea*, Amyot et Serville, Hémi. p. 453.
 1848. *Notonecta*, var. *marmorea*, Amyot, Ent. Franc., Rhynch. p. 337, nom. invalid.

1851. *fabricii*, var. *marmorea*, Fieber, Abh. Böhm. Gesel. Wis. (5) vii. p. 474.
 1861. *fabricii*, var. *marmorea*, Fieber, Eur. Hem. p. 101.
 1868. *glauca*, var. *marmorea*, Stål, Svensk. Vet.-Akad. Handl. vii. no. 11 (Hem. Fabr.), p. 136.
 1880. *glauca*, var. *marmorea*, Puton, Synop. Hém. Hétér. France, iii. p. 217.
 1897. *glauca*, var. *marmorea*, Kirkaldy, Rev. d'Ent. xvi. pp. 223, 224.
 1897. *glauca*, var. *marmorea*, Kirkaldy, Trans. Ent. Soc. London, 1897, p. 421.
 1906. *glauca*, var. *marmorea*, Distant, Faun. Brit. Ind., Rhynch. iii. p. 42.
 1909. *glauca*, var. *marmorea*, Oshanin, Verz. Palæ. Hem. i. p. 975.
 1909. *viridis*, Delcourt, Bull. Sci. France et Belgique, xliii. p. 379, partim.
 1925. *viridis*, Poisson, Bull. Soc. Ent. France, p. 328, fig. 1, O.
 1927. *viridis meridionalis*, Hutchinson, Ann. & Mag. Nat. Hist. (9) xx. p. 375, nom. præocc.
 1928. *viridis mediterranea*, Hutchinson, Ent. Month. Mag. lxiv. p. 35, nom. nov. for *meridionalis*, Hutchinson, 1927.
 1928. *viridis meridionalis*, Poisson, Bull. Soc. Ent. France, no. 6, p. 107.

2 b. *Notonecta marmorea viridis*, Delcourt (10), 1909.

1848. ? *Notonecta*, var. *pallida*, Amyot, Ent. Franc., Rhynch. p. 337, nom. invalid. (11).
 1897. *glauca*, var. *glauca*, Kirkaldy (12), Trans. Ent. Soc. London, 1897, p. 421, partim.
 1909. *viridis*, Delcourt, Bull. Sci. France et Belgique, xliii. p. 379, tab. iv. lin. 2, tab. v. lin. 18.
 1918. *halophila*, Edwards, Ent. Month. Mag. liv. p. 58.
 1923. *halophila*, Butler, Biol. Brit. Hem. Heter. p. 559.
 1925. *viridis*, Poisson, Bull. Soc. Ent. France, 1925, p. 256.

**3 a. *Notonecta obliqua obliqua*, Gallén, 1787
 (= *furcata*, auct.).**

1787. *obliqua*, Gallén (13), Mus. Nat. Acad. Upsal. pt. v. p. 61.
 1794. *furcata*, Fabricius, Ent. Syst. iv. p. 58.
 1799. *furcata*, Coquebert, Ill. Icon. Ins. p. 38, tab. x. fig. 2.
 1803. *furcata*, Fabricius, Syst. Rhynch. p. 102.
 1807. *furcata*, Haworth, Trans. Ent. Soc. London, i. p. 98.
 1817. *furcata*, Leach, Trans. Linn. Soc. London, xii. pt. i. p. 12.
 1826. *melanota*, Leach et Risso (14), Hist. Princ. Prod. Eur. Mérid. (Risso), v. p. 215.
 1829. *furcata*, Gallén, Hém. Svec. p. 178.
 1835. *glauca*, var. *a*, Burmeister, Handb. Ent. ii. p. 190.
 1835. *furcata*, Herrich-Schäffer, Nomencl. Ent. i. p. 63.
 1840. *fuscata* (!), Spinola, Essai Ins. Hem. p. 59.
 1840. *glauca*, var. *furcata*, Blanchard, Hist. Nat. Ins. iii. p. 89.
 1843. *glauca*, var. *furcata*, Amyot et Serville, Hém. p. 453.
 1845. [sine nom.] Herrich-Schäffer, Wanz. Ins. viii. p. 24. no. 4.
 1848. *Notonecta*, var. *furcata*, Amyot, Ent. Franc., Rhynch. p. 337, nom. invalid.
 1851. *fabricii*, var. *furcata*, Fieber, Abh. Böhm. Gesel. Wis. (5) vii. p. 474,

1861. *fabricii*, var. *furcata*, Fieber, Eur. Hem. p. 101.
 1865. *glauca*, var. *furcata*, Douglas et Scott, Brit. Hem. i. p. 588.
 1880. *glauca*, var. *furcata*, Puton, Synop. Hém. Hétér. France, iii. p. 217.
 1892. *glauca*, var. *furcata*, Saunders, Hem. Heter. Brit. Is. p. 329, tab. lxxi. fig. 2.
 1897. *glauca*, var. *marginata* (15), Kirkaldy, Trans. Ent. Soc. London, 1897, p. 421.
 1904. *fabricii*, var. *fasciata* (!), Kirkaldy ("fide Fieber, 1861"), Wien. Ent. Zeit. xxiii. pp. 95, 132.
 1905. *glauca*, var. *furcata*, Hübner, Jahresh. Ver. Vaterl. Naturk. Württemberg, lxi. p. 117.
 1906. *glauca*, var. *marginata*, Distant, Faun. Brit. Ind., Rhynch. iii. p. 41.
 1909. *glauca*, var. *furcata*, Oshanin, Verz. Palæ. Hem. i. p. 975.
 1909. *glauca*, var. *furcata*, Kuhlitz, Süsswasserf. Deutschl. (Brauer), vii. p. 81.
 1923. *furcata*, Butler, Biol. Brit. Hem. Heter. p. 559.

3 b. *Notonecta obliqua meridionalis*, Poisson, 1926.

1925. *furcata*, Poisson, Bull. Soc. Ent. France, 1925, p. 270.
 1925. *furcata*, Poisson, Bull. Soc. Ent. France, 1925, p. 328, fig. 3.
 1926. *furcata*, var. *meridionalis*, Poisson, Bull. Soc. Hist. Nat. Afrique Nord, xvii. p. 240.
 1928. *furcata meridionalis*, Poisson, Bull. Soc. Ent. France, no. 6, p. 106.

4. *Notonecta maculata*, Fabricius, 1794.

1794. *maculata*, Fabricius, Ent. Syst. iv. p. 58.
 1799. *maculata*, Coquebert, Ill. Icon. Ins. p. 38, tab. x. fig. 1.
 1800. *glauca*, Schellenberg, Cimic. Helvet. p. 21, tab. x.
 1803. *maculata*, Fabricius, Syst. Rhynch. p. 103.
 1817. *maculata*, Leach, Trans. Linn. Soc. London, xii. pt. i. p. 12.
 1824. *maculata*, Curtis (16), Brit. Ent. (ed. i), i. pl. x.
 1826. *variegata*, Leach et Risso, Hist. Princ. Prod. Europ. Mérid. (Risso), v. p. 216.
 1835. *marmorea*, Herrich-Schäffer (17), Nomencl. Ent. i. p. 63.
 1840. *glauca*, var. *marmorea*, Blanchard, Hist. Nat. Ins. iii. p. 89.
 1843. *glauca*, var. *maculata*, Amyot et Serville, Hém. p. 453.
 1845. *maculata*, Herrich-Schäffer (fide Curtis) = *marmorea*, Herrich-Schäffer, Wanz. Ins. viii. p. 23, tab. cclvi. fig. 797.
 1848. *Notonecta*, var. *maculata*, Amyot, Ent. Franc., Rhynch. p. 338, nom. invalid.
 1851. *fabricii*, var. *umbrina*, Fieber, Abh. Böhm. Gesel. Wis. (5) vii. p. 474.
 1861. *fabricii*, var. *umbrina*, Fieber, Eur. Hem. p. 101.
 1865. *maculata*, Douglas et Scott, Brit. Hem. i. p. 588.
 1880. *glauca*, var. *umbrina*, Puton, Synop. Hém. Hétér. France, iii. p. 218.
 1892. *glauca*, var. *maculata*, Saunders, Hem. Heter. Brit. Is. p. 329.
 1897. *glauca*, var. *maculata*, Kirkaldy, Rev. d'Ent. xvi. pp. 222, 224.
 1897. *glauca*, var. *maculata*, Kirkaldy, Trans. Ent. Soc. London, 1897, p. 422.

1905. *glauca*, var. *marmorea*, Hübner, Jahresh. Ver. Vaterl. Naturk. Württemberg, lxi. p. 116.
 1905. *glauca*, var. *maculata*, Hübner, loc. cit. p. 117.
 1909. *glauca*, var. *maculata*, Oshanin, Verz. Palæ Hem. i. p. 975.
 1909. *marmorea*, Kuhlitz, Süßwasserf. Deutschl. (Brauer), vii. p. 81.
 1923. *maculata*, Butler, Biol. Brit. Hem. Heter. p. 559.
 1925. *maculata*, Jaczewski, Ann. Zool. Mus. Polon. Hist. Nat. iv. p. 128, fig. 2.

Var. *fulva*, de la Fuente, 1898.

1898. *glauca*, var. *fulva*, de la Fuente, Ann. Soc. Esp. Hist. Nat. xxvi. p. 130.
 1927. *maculata*, var. *fulva*, Hutchinson, Ann. & Mag. Nat. Hist. (9) xix. p. 375.
 1928. *maculata*, var. *fulva*, Hutchinson, Ent. Month. Mag. lxiv. p. 35.
 1928. *glauca*, var. *fulva*, Poisson (18), Bull. Soc. Ent. France, no. 6, p. 106.

5. *Notonecta pallidula*, Poisson.

1897. *glauca*, var. *maculata*, "leucochroic form" (19), Kirkaldy, Trans. Ent. Soc. London, 1897, pp. 422, 423.
 1926. *pallidula*, Poisson, Bull. Soc. Hist. Nat. Afr. Nord, xvii. p. 238, figs. 1, 2.
 1927. *horváthi*, Esaki, Ann. & Mag. Nat. Hist. (9) xx. p. 284, figs. 1, 2, 4.
 1928. *pallidula*, Hutchinson, Ent. Month. Mag. lxiv. p. 35.
 1928. *pallidula*, Poisson, Bull. Soc. Ent. France, no. 6, pp. 105-106.

6. *Notonecta lutea*, Müller, 1776.

1776. *lutea*, Muller, Zool. Dan. Prodr. p. 103.
 1778. *lutea*, Goeze, Ent. Beytr. ii. p. 170.
 1829. *lutea*, Fallén, Hem. Svec. p. 178.
 1835. *unicolor*, Herrich-Schäffer, Nomencl. Ent. i. p. 63.
 1845. *unicolor*, Herrich-Schäffer, Wanz. Ins. viii. p. 23.
 1851. *lutea*, Fieber, Abh. Böhm. Gesel. Wis. (5) vii. p. 473.
tumida, Germar (20), in litt. (*vide* Fieber, 1851, loc. cit.).
 1860. *lutea*, Flor, Rhynch. Livl. i. p. 774.
 1861. *lutea*, Fieber, Eur. Hem. p. 100.
 1897. *lutea*, Kirkaldy, Trans. Ent. Soc. London, 1897, p. 425.
 1905. *lutea*, Hübner, Jahresh. Ver. Vaterl. Naturk. Württemberg, lxi. p. 118.
 1909. *lutea*, Oshanin, Verz. Palæ Hem. i. p. 976.
 1909. *lutea*, Kuhlitz, Süßwasserf. Deutschl. (Brauer), vii. p. 82.
 1912. *lutea*, Jensen-Haarup, Danmarks Fauna, xii. (Taeger), p. 31.
 1928. *lutea*, Hutchinson, Ent. Month. Mag. lxiv. p. 35, figs. 1, 2.

Var. *scutellaris*, Reuter, 1886.

1886. *lutea*, var. *scutellaris*, Reuter, Medd. Soc. Faun. Flor. Fenn. xiii. p. 234.
 1897. *lutea*, var. *scutellaris*, Kirkaldy, Trans. Ent. Soc. London, 1897, p. 425.

1909. *lutea*, var. *scutellaris*, Oshanin, Verz. Palæ. Hem. i. p. 976.
 1927. *lutea*, var. *scutellaris*, Esaki, Ann. & Mag. Nat. Hist. (9) xx.
 p. 286, footnote.

Var. *schumacheri*, Schirmer (21), 1911.

1911. *lutea*, var. *schumacheri*, Schirmer, Deutsch. Ent. Zeit. 1911,
 p. 680.

SPECIES OF UNCERTAIN POSITION.

Notonecta octopunctata (22), Goeze, 1778.

1766. *secunda*, Schaffer, Icon. Ins. Ratisb. i. pt. i. tab. xcvii. fig. 1,
 nom. invalid. et nud.
 1778. *octopunctata*, Goeze, Ent. Beytr. ii. p. 169.
 1789. *octopunctata*, Gmelin, Syst. Nat. (Linné), ed. xiii. p. 2119.
 1804. *glauca*, Panzer, Schäfferi Icon. Ins. Ratisbon., Enum. Syst. i.
 p. 108.

NOTES.

(1) With respect to this fact I am much obliged to Mr. W. E. China and Dr. D. MacGillavry for their kind information. In England it is found in several localities [see Hutchinson, Ent. Month. Mag. lviii. p. 255 (1922)]. Mr. China also collected a single specimen in brackish water (Vale Pond) on Guernsey (Channel Islands) in August 1927. In February 1928 Mr. China and the author collected numerous specimens of this insect in the salt marsh near Gravesend, Kent, at the mouth of the Thames, where Kirkaldy's specimens had originated, and observed that this form and the common *glauca* are apparently mutually exclusive, and that they are never found mixed together, though we found both the forms in the same vicinity. The nature of the water of these places was readily determined by the difference in vegetation and by the presence of a shrimp which does not occur in fresh water. In Holland also *viridis* is found only in brackish water near the sea-shore. Through the courtesy of Dr. MacGillavry I have received a male specimen from Marken Island in the Zuider Zee, which is absolutely identical with the English specimens. *Notonecta viridis*, Delcourt, may also be found in Denmark, as, according to Jensen-Haarup (1912, *loc. cit.*), "*N. glauca*" is sometimes found there in brackish water.

(2) According to Delcourt [Bull. Sci. France et Belgique, xlii. p. 380 (1909)] and Poisson [Bull. Soc. Ent. France, 1925, p. 256 (1925)], this species is generally found in brackish water in France also; but it is not certain whether

the specimens from Chaville, near Paris, reported by Delcourt, were also collected in brackish water as the locality is some distance from the sea-shore.

(3) Reported by Distant as *Notonecta glauca*, Linné, var. *marmorea*, Fabricius [Faun. Brit. Ind., Rhynch. iii. p. 42 (1906)].

(4) Trans. Ent. Soc. London, 1897, p. 419 (1897).

(5) A more complete classical bibliography of this species is found in Hübner, 1905, *loc. cit.*

(6) This work was published in Regensburg, 1766, and reprinted in Erlangen, 1804, with the systematic nomenclature by Panzer; but I have seen only a copy of the latter edition. All the figures are hand-coloured, and the specific names are represented by an ordinal number according to the genus, with or without a very short description.

(7) The eighth volume of this work was published in several separate parts and completed in 1848. The first part (pp. 1-28), in which this species is included, was published in September 1845.

(8) This paper, "Rhynchotographien," *loc. cit.* pp. 424-488, was separately paginated in the reprints, and many authors have referred to the pagination of the latter.

(9) Fabricius described this species from Algeria as follows:—"Statura omnino *N. glaucæ*. Caput et thorax glauca, immaculata. Scutellum atrum. Elytra testacea, fusco maculata. *Corpus nigrum pedibus glaucis*." This description well agrees with the Mediterranean form of *N. viridis* auct. (= *mediterranea*, Hutchinson). Delcourt (1909, *loc. cit.* p. 377) says:—"Les Notonectes décrites sous ce nom (*marmorea*) par Fabricius sont à Copenhague, où j'ai pu les examiner, grâce à l'obligeance du Dr. Meinert. Elles sont au nombre de deux et ne sont autres que la *maculata* du même. Fabricius a en effet, en 1794, décrit, sous le nom de *maculata*, des individus de la collection Bosc, provenant des environs de Paris, qui sont d'ailleurs au Muséum, à Paris, et, en 1803, décrit de nouveau, sous le nom de *marmorea*, des individus de la même forme, de la collection de Sestestedt, provenant des environs d'Alger. Les caractères tout à fait particuliers de coloration jaune d'une partie des tergites et tout l'ensemble ne permettent pas d'en douter." Thus Delcourt synonymized *marmorea* with *maculata*, but he does not actually mention whether or not he examined the dorsal surface of the Fabrician specimens, and he was ignorant of the pronotal difference between *viridis* and *maculata*. I am of the opinion that the type-specimens of authors writing at the time, when the conception of the

type-specimen was not yet established, cannot be accepted as the standard of the species, unless they well agree with the description of the author, because in those days so many specimens were not or insufficiently labelled that there were a great many possibilities of confusion. In this case Fabricius distinctly says: "*Corpus nigrum*," which is not the case in *maculata*; while in the description of *maculata* [Ent. Syst. iv. p. 58 (1794)] he says: "Abdomen atrum, fascia baseos apiceque fulvis." He also says of *N. marmorea*: "*Scutellum album*," a statement which was followed by Coquebert [Ill. Icon. Ins. p. 38 (1799)], but this may have been written in error, because the scutellum of this species is black in the figure given by the latter author, and Herrich-Schäffer [Wanz. Ins. viii. p. 24 (1845)] and Douglas and Scott [Brit. Hem. i. p. 589 (1865)] all regarded this as an error for "atrum." In a previous publication [Bull. Brooklyn Ent. Soc. xxi. pp. 177-181 (1926)] I have synonymized the Linnean name *Nepa cinerea* with *Nepa rubra* by the same author. In that case, although I was influenced by an examination of the Linnean type, the character given by Linné in his description of *Nepa rubra*—i. e., the veins of the hind wing are sanguineous—is not found at all in *Laccotrephes ruber*, auct., and occurs only in *Nepa cinerea*, auct., among the known species of this group of insects. "*Rubra*" means not only the red surface of the abdomen but also the red wing-veins, as Goeze [Ent. Beytr. ii. p. 173 (1778)] calls this species "*Rothader*." Although both *Nepa rubra* and *N. cinerea* are described on the same page [Syst. Nat. ed. x. p. 440 (1758)], the former is described before the latter. But whether we should use the name *Nepa rubra*, Linné, for the common European species, *Nepa cinerea*, auct., or not, that is another question. In any case the name "*rubra*" cannot be used for *Laccotrephes ruber*, auct. If we were to "revise" nomenclature according to the "types" of the classic authors, neglecting the descriptions, drastic alterations would have to be made. The Linnean type of *Cimex lacustris* is not *Gerris lacustris*, auct. (type of *Gerris*), but *Gerris asper*, auct., and those of *Empicoris* (= *Ploiariola*) *vagabundus* (auct.), a Reduviid, and *Gastrodes abietis* (auct.), a Lygæid, both regarded as the types of their respective genera, are nothing but Mirids. (These "types" are to be found in the Linnean collection, preserved by the Linnean Society of London.) In the present case, at least, the *Notonecta marmorea* of most of the later authors is certainly identical with *Notonecta viridis mediterranea*, Hutchinson. Poisson (Bull. Soc. Ent. France,

1928, no. 6, pp. 106 & 107) apparently still regards *N. marmorea*, F., as a colour-form of *N. glauca*, L. He states that the differences exhibited by the southern forms of *N. glauca* and *N. viridis* are not sufficient to consider them as a distinct subspecies, and suggests that *N. viridis meridionalis* (= *mediterranea*), Hutchinson, is merely a colour-variety of *N. viridis*, Delc., as *N. marmorea*, F., is a variety of *N. glauca*, L. Consequently, he says, these names should "disappear from nomenclature."

(10) Under *Notonecta viridis*, Delcourt included both the Channel and Mediterranean subspecies, and, as he did not fix the type of the species, I herewith fix the Channel (brackish) form as *viridis*, as has been treated by previous authors.

(11) As Delcourt says (*loc. cit.*) the description of *pallida*, Amyot, agrees well with some specimens of *viridis*, Delcourt. He says: "la diagnose de *N. pallida*, Amyot: *D'un blanc verdâtre pâle, sans les taches noires des hémélytres*, ne peut lui être appliquée malgré son peu de précision. J'en donnerai ultérieurement une diagnose complète, déterminer ce qui est caractéristique de cette forme, notamment dans l'armature génitale" (p. 380). A name is not to be invalidated because the diagnosis is not precise, otherwise we should have to ignore most of the classic names in modern taxonomy. Amyot's name cannot be accepted only because his work is based on the "méthode mononymique." This work had been published in Ann. Soc. Ent. France before it appeared as a separate book, and the name *pallida* is found in (2) iv. p. 451 (1847).

(12) Kirkaldy states: "I have taken small examples of this variety near Gravesend (England) in company with marine Crustacea." These specimens are now kept in the British Museum, and undoubtedly belong to this species.

(13) The name *obliqua* was referred to "Thunberg, DD. Ac. Mus. Upsal. p. 61" by Kirkaldy. The correct title of this book is: "Museum Naturalium Academiæ Upsaliensis (præsidente C. P. Thunberg)," and different parts were worked out by different authors. Part V. (pp. 59-68), "Donation Thunbergianæ 1785, Continuat. III," in which this species is included, was written by Olavus Gallén, not by Thunberg, and was published in 1787 (according to Hagen, Bibl. Ent., on December 5th). His description is as follows: "Hemelytra nigris lineis duabus obliquis abbreviatis cinereis." This agrees quite well with *Notonecta furcata*, Fabricius, and therefore I have synonymized the latter with *obliqua*, Gallén.

(14) The author of *melanota* was regarded by Fieber, 1851, *loc. cit.*, as "Risso," but in the original description it is cited as "L.-R.," which is an abbreviation of "Leach-Risso" (see Risso, *op. cit.* p. 206).

(15) Kirkaldy identified this species, *Notonecta furcata*, auct., with *Notonecta marginata*, Müller. Müller writes: "*N. marginata* elytris nigris: margine suturaque luteis" [Zool. Dan. Prodr. p. 104 (1776)]. This description does not agree with this species, and although "*furcata*" is mentioned by Jensen-Haarup in 'Danmarks Fauna,' I have no verification of its occurrence; in any case it is not a common form in Denmark, so that I do not agree with Kirkaldy's opinion. On the other hand, *marginata*, Müller, is most probably identical with one of the *Corixa* (sensu lat.) species, as the description covers all the forms which are common in Denmark, and *marginata* was placed by Müller between *Notonecta striata* and *N. minutissima*, both of which are Corixids. The British Museum copy of Müller's work originally belonged to J. C. Schiödte, the well-known Danish Hemipterist, and among his annotations he writes of *Notonecta marginata* "= *Corixa hellensi*, Fallén, 183," so that there is little doubt as to the generic identity of Müller's species.

(16) The plate containing this species was placed in a different volume in the later editions of this work.

(17) *Notonecta marmorea*, Herrich-Schäffer, may be *N. maculata*, Fabricius, though his description agrees with both the forms, because he believed that *N. maculata*, Curtis, might be identical with *N. marmorea*, Herrich-Schäffer (see Herrich-Schäffer, 1845, *loc. cit.*).

(18) Poisson (Bull. Soc. Ent. France, no. 6, p. 106) suggests that when *N. glauca*, var. *fulva*, was described, Fuente had before him specimens of *N. pallidula*, Poisson. Judging, however, from specimens which agree very well with Fuente's description (collected by Mr. W. E. China in August 1927 in Guernsey, Channel Islands), this form is undoubtedly a variety of *N. maculata*, F., as pointed out by Hutchinson (Ent. Month. Mag. lxiv. p. 35).

(19) The specimens regarded by Kirkaldy as the "leucochroic form" of *maculata* in the National Museum of Natural History in Paris are the types of *Notonecta horváthi*, Esaki.

(20) The specimen from Barnaul, W. Siberia, labelled by Germar as "tumida" is now kept in his collection in the Zoological Institute of the University, Lwów (Lemberg).

(21) In this striking variety the dorsal surface of the

body is totally black except the head and pronotum. There is, in the British Museum, a single male specimen of this species from St. Petersburg, Russia, exhibiting an intermediate grade of melanism between *scutellaris*, Reuter, and *schumacheri*, Schirmer. In this specimen the middle area of scutellum, costal half of corium, as well as the basal area of membrane are black.

(22) The description of *Notonecta octopunctata*, Goeze, is undoubtedly based on Schäffer's figure of *Notonecta secunda*, and not on an actual specimen. Both figure and description are so bad that the name cannot be assigned to any known species. It is possible, however, that Schäffer's figure was meant to represent *Notonecta maculata*. If this is so, *N. maculata* would have to be known as *N. octopunctata*, which has priority. In spite of the greater resemblance of the figure to *maculata* it is better to follow Panzer (1804, *loc. cit.*), who, by identifying Schäffer's figure with *N. glauca*, indirectly synonymized Goeze's species *N. octopunctata* with *N. glauca*, Linné.

VII.—*New Oriental Asilidæ (Diptera).*

By E. BRUNETTI*.

Stenopogon nigrofasciatus, sp. n.

♀. Length about 11 mm.; length of wing 10 mm.

Head: frons a little broader than face and slightly wider in middle, covered with yellowish-grey minute pubescence, a row of medium-sized yellow bristles near eye-margins. Ocellar triangle situate on vertex, barely raised, blackish; ocelli dirty grey. (Antennæ missing in case of type.) Face nearly one-fifth as wide as head, with nearly parallel sides, and with minute white pubescence, upper part flush with eyes, lower part moderately prominent. Mystax consisting of a bunch of long brownish-yellow bristles, not extending to sides of face. Proboscis rather short (about equal in length to two-thirds of height of head), shining black, with a little pale pubescence; palpi black, with some pale

* [The following descriptions of new species, drawn up in 1926 by the late Mr. Brunetti, had not been published at the time of his death on January 21st, 1927, and were found among his papers. Mr. F. Barnett has carefully checked them and compared them with the types, all of which are in the British Museum (Natural History).—E. E. AUSTEN.]

pubescence. Occiput yellowish-grey dusted, nearly covered with bright yellow bristly pubescence.

Thorax: neck more or less dark grey, with darker marks; an upper transverse fringe of yellow bristly hairs, and finer concolorous hairs at sides. Dorsum yellowish grey, with the usual three dorsal stripes, of which the median one is narrowly divided and the outer ones are considerably fore-shortened, all three practically united on disc, forming a large blackish subquadrate spot. Pleuræ concolorous with dorsum or slightly paler. Scutellum blackish, with a row of yellow bristly hairs on hind margin. A fringe of long brownish-yellow bristles on metapleura. Metanotum blackish, bare, rather shining.

Abdomen yellowish-grey; second, third, fourth, and fifth segments with a broad black band on anterior margin, filling more than half of each segment and reaching sides; hind margins of third and fourth segments with an orange-red tinge; last two segments shining dark brown. Whole abdomen with microscopic yellow pubescence. The usual longer pale hairs at sides of first segment.

Legs mainly orange-brown. Coxæ all with a little black at the base; front of anterior pairs and hinder side of hind pair grey. Femora with median part broadly black on inner side of fore pair, on front and upper sides of middle pair, and with a nearly complete band on hind pair. Tarsi blackish at the tips. Pubescence on legs short, whitish; some short yellow pubescence on hinder side of hind tibiæ. Fore and middle femora with red-brown small spiny bristles on hinder side, near tips. Tibial spines inconspicuous; claws black, pulvilli pale yellow.

Wings pale brown, venation normal, halteres yellowish.

One ♀: India, Darjeeling district, Teesta Road, 1100 ft., 4. vi. 1920 (*R. Senior-White*).

Stichopogon maculipennis, sp. n.

♀. Length 7 mm.; length of wing 5 mm.

Head: frons shining black, practically bare, distinctly broader in middle; ocellar triangle well raised, concolorous, one pair of bristles. Face shining black, just below antennæ one-fifth as wide as head, a little broader below. Mystax composed of a small bunch of black spiny bristles and stiff hairs. Proboscis shining black, short, with a little pale pubescence; palpi black, nearly bare. Antennæ cylindrical, second segment barely half as long as first, both brown-orange with blackish marks and a few short, black, stiff

hairs (third segment missing in case of type). Occiput dark grey, flush with eyes; lower half with short black bristly hair.

Thorax: neck shining black, with a fringe of stiff black hairs on anterior margin, and fine black hairs at sides. Dorsum shining black, with a little moderately dark grey dust; humeri prominent, very shining. Two rows of dorso-centrals, with 5 or 6 fine black bristles in each. Pleuræ shining black; metapleura with a row of about 5 or 6 long, fine, black bristles. Scutellum black, inconspicuously grey-dusted, one pair of conspicuous, apical, spiny bristles; metanotum grey-dusted, bare of bristles.

Abdomen shining black, almost punctate; hind margins of middle segments very narrowly grey-dusted; abdominal pubescence fine and pale, rather sparse, a little longer at sides of first segment; venter black.

Legs: coxæ, anterior femora, and basal third of hind femora orange-yellow; legs otherwise mainly black, but tips of hind femora somewhat pale, and middle tibiæ more or less pale basally. Pubescence of legs fine, whitish. Fore tibiæ with a row of long, fine bristles on outer side, shorter ones on front side, and a long bristle towards tip on inner side. Middle tibiæ with long bristles on inner, front, and outer sides, short and weak ones on posterior side; hind tibiæ with long ones on front, outer, and posterior sides. Short pubescence on hind tibiæ much denser than elsewhere; all bristles very pale yellow, mostly fine and long; claws black, pulvilli pale yellow.

Wings grey; venation normal, veins black; blackish suffusions from base of third vein to tip of anal cell, on distal side of discal cell, on fork of third vein, and generally over wing-tip; halteres yellowish.

One ♀: Ceylon; Trincomali, 8. x. 1919 (*R. Senior-White*).

The wing-suffusions just described serve to distinguish this species from all its Oriental congeners known to me.

Microstylum whitei, sp. n.

♀. Length 27 mm.; length of wing 20 mm.

Head: frons and face with nearly parallel sides, former just appreciably wider in middle, both nearly one-fourth as wide as head. Frons with light brownish-yellow tomentum and a row of 5 or 6 spiny bristles towards each side, pale yellow with exception of an uppermost dark one. Ocellar tubercle barely raised, concolorous, without long bristles,

but with a pair of small ones; ocelli shining yellowish, with black reflections. Face with silky yellowish-grey tomentum, nearly flush with eyes. Mystax consisting of a pair of powerful pale yellow spines, and a row of yellowish bristly hairs of various lengths on each side. Proboscis normal, black, fully as long as head, with fine whitish pubescence at base; palpi black, with black bristles and some soft whitish pubescence at base. Antennæ black; first and second segments cylindrical, subequal, with the usual few black bristles; third segment as long as first and second segments together, narrowed at base, otherwise oval with moderately pointed tip. Occiput white-dusted, with soft concolorous pubescence, and on upper part with distinct yellow bristles, amongst which may be found one or more darker ones.

Thorax with yellowish-grey tomentum; neck with a transverse row of black spines, including one or two pale ones; also a very strong black spine on each side of collar; lower part of neck in front with soft white pubescence. Dorsum rather dark brownish-grey; margins and the various areas outlined with yellowish-grey, as is also the space between the rather narrow median stripes; entire surface covered with minute black bristles. Humeri with golden-yellow tomentum, with at least 3 bristles; 4 strong post-humeral ones, 3 very powerful presutural, these latter two rows to some extent overlapping one another; 2 strong supra-alar, 3 on posterior calli; 3 dorso-central, the hindmost one the weakest, all on hinder part of dorsum. Pleuræ ash-grey: mesopleura and propleura more brownish about their centres; propleura with some pale yellow bristles; metapleura with a row of medium-sized pale yellow bristles. Scutellum with pale yellowish-grey tomentum, and an apical pair of cruciate bristles; metanotum grey, with a bunch of pale yellow, soft, stiff hair on each side.

Abdomen with first four segments pale yellowish-grey dusted, the centre in each case occupied by a large quadrate shining black spot lying on anterior margin, rest of dorsum shining black. Whole abdomen with minute yellowish-buff bristles, and a medium-sized bunch of pale yellow bristles and pubescence at sides of first segment. The usual apical circlet of dark red-brown spines. Venter with basal half mainly greyish, apical half black.

Legs: coxæ ash-grey dusted, with pale yellow bristles and fine white pubescence on outer sides of all pairs and on front side also of fore pair. Rest of legs orange-brown,

upper side of anterior femora blackish; tips of tarsal segments a little darker brown and more shining. Fore femora with a rather small bristle on posterior side near tip; middle femora with a row of bristles on outer side and one on inner side near tip. Fore tibiae with two rows of bristles on anterior and one row on outer side, with a few additional ones on latter side; middle pair with two rows on outer and two on posterior side; hind pair with two rows on anterior and two on posterior side, apparently not quite regularly placed. Tarsal bristles normal; claws black, pulvilli pale yellow.

Wings pale yellowish grey, with just a suspicion of suffusion along veins; halteres brownish.

Two ♀ ♀ (type and paratype): Ceylon, Kanthalai, 5-6. x. 1919 (*R. Senior-White*).

Microstylum rufoabdominalis, sp. n.

♀. Length 28 mm.; length of wing 21 mm.

Head: frons and face approximately of equal width, about one-fifth as wide as head, but frons appreciably wider in middle. Ocellar region black, with numerous black bristles, rest of frons with yellowish-grey tomentum; towards each side of frons a row of black bristles of various sizes, including 4 strong ones; 2 or 3 lesser yellow ones also present. Face almost flush with eyes, barely prominent even at mouth-opening, covered with yellowish-grey tomentum. Mystax of 6 very strong black spines. Proboscis as long as height of head, gradually tapering, shining black, with a moderate amount of pubescence at base; palpi about half as long as proboscis, black, with black bristles. Antennae black, cylindrical, first and second segments with usual black bristles (third segment missing in case of type). Occiput whitish-grey dusted; a row of strong black spiny bristles across upper half, well clear of margins, the row descending in V-shaped form behind vertex; lower part of occiput with fine greyish-white pubescence.

Thorax: neck blackish brown, with usual row of black bristles on upper side across middle; some long bristly blackish-brown pubescence on each side. Dorsum blackish, margins, ends of suture, and the various areas narrowly outlined with brownish grey. Whole surface with minute black bristles. Humeri with 3 or 4 strong black spines, and shorter black bristles of varying length. Four very powerful spines between humeri and suture; 2 beyond suture, and 2 on well-developed posterior calli; 3 strong dorso-central spines towards hinder part. Sides of thorax rather dark

grey dusted, with a row of 7 or 8 moderately strong black bristles on metapleura. Scutellum rather light grey dusted, with a well-separated apical pair of cruciate bristles; metanotum black, with grey reflections in certain lights, and a little stiff black pubescence towards sides.

Abdomen all red-brown, gradually tapering, shining, more than twice as long as thorax; though at first sight apparently bare, a closer scrutiny shows some very small black hairs on the first three segments and rufous hairs at the tip; the usual apical circle of dark brown spines.

Legs all black, except basal half of first segment of hind tarsus, which is dull orange; general short pubescence on legs black or blackish. Coxæ, especially posterior pairs, grey-dusted, with some black and pale yellow bristles intermixed. Femora destitute of strong bristles, except 3 medium-sized ones on front side of middle pair, and 1 similar bristle on hinder side near tip, with a smaller one near base; hind femora with a few comparatively weak short bristles on outer and under sides. Fore tibiæ with two rows of bristles on front side and one on outer; middle tibiæ with one row on outer and hinder sides respectively, and two rows on inner side; hind tibiæ with two rows, apparently not always complete, on front side. Tarsal bristles normal; claws black; pulvilli dull orange.

Wings rather dark yellowish brown, veins black; halteres brownish.

One ♀: Ceylon, Kanthalai, 6. x. 1919 (*R. Senior-White*).

Microstylum basalis, sp. n.

♂. Length 28 mm.; length of wing 22 mm.

Head: eye-facets normal; vertex grey-dusted, except broadly in ocellar region, which is shining black, with short black bristly hairs (long bristles apparently broken off in case of type); four moderately short spines on each side towards eye-margins, with some stiff black hairs intermixed. Antennæ with first and second segments black, subequal (third segment missing in case of type). Face parallel-sided, nearly one-fifth of head in width, whitish-grey dusted and devoid of pubescence, almost flush with eyes and barely produced over mouth-opening. Mystax composed of a little curved row of four long yellowish spines. Proboscis barely longer than height of head, shining black and bare; palpi black, with bristly black pubescence. Occiput yellowish-grey dusted, a fringe of fine black bristles well clear of margins on about upper third; remainder with yellowish-grey pubescence, which is much longer below.

Thorax: neck and pronotum blackish, with yellowish-grey reflections on hind margins; a row of fine black bristles on upper side, and rather long and ragged yellow pubescence below. Dorsum blackish, dorsal margins, humeri and posterior calli, suture and a narrow median stripe outlined with yellowish grey. Pubescence on dorsum practically confined to some very short stiff black hairs in median line; short black bristles in humeral region. Two post-humeral, 3 pre-sutural black spines, 3 supra-alar, and 3, perhaps 4, on hind calli. Four strong dorso-central spiny bristles on hinder part of dorsum, with some long black stiff hairs in that region. Pleuræ grey-dusted, bare, except for a vestige of pale yellow pubescence here and there; metapleura with a row of black bristles of medium length; hypopleura grey-dusted, with a few black spiny bristles of medium size.

Abdomen mainly black; first, second, and third segments greyish-white dusted, first rather more yellowish, with a little soft yellow pubescence at extreme sides, and a small bunch of medium-sized black bristles at each anterior angle. A little fine pale yellow hair in middle of sides of the rather long second segment; next following segments a little grey-dusted at sides; remainder of abdomen black. Entire dorsum with almost imperceptible short sparse pubescence, which is black on some parts and pale on others. Venter dark grey, nearly bare. Genitalia moderately large, shining black, reddish brown in parts, with a little black pubescence.

Legs black. Coxæ grey-dusted, with a little whitish pubescence; femora apparently bare, the microscopic black pubescence almost imperceptible. One very short stout black bristle at three-fourths of outer side of fore femora; a small one at first and second thirds on front side, with a subapical one on hinder side, of middle femora; and a subapical one on outer and inner side, with one near base on outer side, of hind femora, all very short. A small brownish-orange spot on under side of anterior femora at tip. Fore tibiæ with very short spiny bristles on front and outer sides; middle pair with similar bristles on all sides, including one or two longer ones; hind pair with similar short ones on front, outer, and hinder sides. Tarsi with normal bristles; pubescence, including that of under side, wholly black.

Wings: anterior and distal parts pale blackish, rest pale yellowish grey, the colour apparently limited apically by the first basal and discal cells. Halteres pale yellowish.

One ♂: Ceylon, Habarana, 11. x. 1919 (R. Senior-White).

VIII.—*New Fresh-water Fishes from Peru, Venezuela, and Brazil.* By GEORGE S. MYERS, Stanford University, California.

Pimelodidæ.

The two forms described below are members of a closely inter-related group of genera distinguished by the more or less flattened, muscle-covered skull. Some of these genera, which include *Heptapterus*, *Acentronichthys*, *Chasmocranus*, *Imparfinis*, *Nannoglanis*, *Myoglanis*, *Leptorhamdia*, and *Brachyglanis*, are of doubtful validity. To the same group possibly belong the blind *Phreatobius*, which in all probability is not a Pygidiid, and the closely related genera *Pseudopimelodus*, *Pteroglanis*, and *Microglanis*, although Regan would separate *Pseudopimelodus* widely from the *Heptapterus*-like forms. *Nannorhamdia* seems closer to *Rhamdia*. It may here be noted that the figure of *Myoglanis potaroensis* given by Eigenmann ('Fishes of Guiana,' 1912, pl. xiv. fig. 1) is in error in showing that fish with a rounded caudal. The caudal in *Myoglanis* is forked, as the description states. The family is much in need of revision, but such revision must be based on a careful study of the osteology.

Leptorhamdia marmorata, sp. n.

Depth 6.2 in body-length *. Head 4.5. Dorsal 1, 6. Anal 12. Eye oval, 4.75 in head, 1.33 in snout, less than one long diameter apart.

Dorsal with a very short spine, its end soft. Distance from snout-tip to dorsal origin exactly three times in body-length. Pelvics originating under middle of dorsal base. Depressed dorsal rays not quite reaching origin of adipose. Adipose long, originating above tips of appressed pelvics, which reach to within 1.5 orbit diameters of the anal. Adipose low, slightly higher posteriorly, its end distinct but, nevertheless, very slightly connected with the upper caudal fulcra. Caudal fin rounded. Maxillary barbel almost reaching posterior end of dorsal base. Anterior nostrils not produced or tubular. Occipital process very short.

Brownish, marbled and spotted with irregular light spots. Venter light. Bases of caudal and dorsal dark, this sharply defined on the former.

Rock-pools at São Gabriel Rapids, Rio Negro, Brazil. Jan.–Feb. 1925. Dr. Carl Ternetz. Type 69 mm., 56 mm. without caudal. Paratype 52 mm., 43 mm. without caudal. Types in Indiana University.

Leptorhamdia is a name used by the late Dr. Eigenmann † to

* Length minus caudal fin.

† Mem. Carnegie Mus. 1918, vii. p. 260, footnote 2.

replace *Leptoglanis*, Eigenmann, preoccupied by *Leptoglanis*, Boulenger. The type of *Leptorhamdia* is *Leptoglanis essequibensis*. The present species differs from the genotype in the strikingly mottled coloration, the fewer anal rays, and the more posterior dorsal fin. It was collected in company with *Chasmocranus longior*, Eigenmann, *Brachyglanis nocturnus*, Myers, and *Pygidium gabrieli*, Myers.

Brachyglanis nocturnus, sp. n.

Depth 7 in body-length. Head 4.17. Depth of caudal peduncle 9. Dorsal I, 6. Anal 11. Eye small and partially embedded, about twice in snout and about 1.5 in interorbital.

Dorsal spine about equal to snout with eye. Distance from snout-tip to base of dorsal spine just three times in body-length. Pelvic fin insertion under middle of dorsal base. Depressed dorsal rays not quite reaching origin of adipose. Adipose long, originating slightly before vertical of anal origin and extending almost to the first caudal fulcrum, the height increasing to the end; it is not connected with the caudal. Appressed pelvics reaching as far back as depressed dorsal rays. Caudal fin forked nearly half its length, the lobes obtusely rounded. Maxillary barbel reaching the base of the third or fourth dorsal ray.

Colour dull blackish brown, lighter on venter. The dark colour ends abruptly in an arc a little beyond the caudal base as in *B. melas*, and the dorsal, pelvics, and anal have a rather sharply-defined dark basal area. The fins are otherwise light translucent brownish.

Rock-pools at São Gabriel Rapids, Rio Negro, Brazil. Jan.-Feb. 1925. Dr. Carl Ternetz. Type 61 mm., 50 mm. without caudal. Type in Indiana University.

This fish closely resembles *Brachyglanis melas*, Eigenmann, but differs in the considerably more anterior dorsal and the longer anal. A paratype of *B. melas* from Crab Falls, British Guiana, 47 mm. in length, is very much deeper than Eigenmann's figure (Mem. Carnegie Mus. v. 1912, pl. xi. fig. 2), but this range in depth is mentioned in the description (p. 157). The position of the dorsal and the anal in the paratype agree with the figure. Two forms may be present in Eigenmann's material.

Brachyglanis is another one of the characteristic genera of the north slopes of the Guiana Highland which has been discovered on the opposite side. Possibly it is premature to state that certain of these genera are typical of the region. *Chasmocranus*, heretofore thought a Guianan genus, is also found in South-eastern Brazil, if *C. truncatorostris*, Borodin, really belongs here (Amer. Mus. Nov. 1927, no. 266, p. 5). The Orinoco system, whence *C. rosæ*, Eigenmann (Rio Meta), was described, appears to belong to the Guianan faunal region.

Ageneiosidæ.*Tympanopleura alta*, E. & M., sp. n.

Head 3. Depth 4. Dorsal I, 6. Anal 32. Eye 3 in snout, about 7 in head.

Dorsal spine smooth anteriorly, posteriorly with thorns. Actual distance of base of dorsal spine to snout-tip (not reduced to horizontal) 2.33 in standard length. Anal fin origin about midway between insertion of pectoral spine and caudal base. Pectoral fin slightly more than reaching pelvic, which in turn considerably overlaps anal origin. Length of dorsal (soft) about .8 of head.

A slight tympanal shade. A dark area across head before eyes. No mark on caudal. Dorsal, pectorals, and pelvics black tipped.

Iquitos, Rio Marañón, Peru (*Dr. W. R. Allen*). Type, 15790 I., 135 mm.

This fish belongs to the genus *Tympanopleura*, formerly known by a few specimens of a species, *T. piperata*, collected at Crab Falls, British Guiana, in 1908. The types of *piperata* were small and probably immature. They may not be different from *alta*, but the deeper body, larger head, longer fins, and different colour of the new fish seem sufficient to separate it. *T. alta* is described jointly by Eigenmann and Myers.

Astroblepidæ.*Astroblepus mancoi*, E., sp. n.

Head 3.5. Depth 5.33-6. Dorsal I, 6. Anal I, 5 or I, 6.

Adipose fin high, arched, beginning at tip of the depressed dorsal spine or further forward, terminating at root of caudal in a minute spine, much more rarely continued without notch to the caudal. Maxillary barbel ending about midway between posterior margin of lip and gill-opening; teeth of the anterior series of premaxillary rather large, pointed or truncate, the median pair usually bicuspid; nasal flap pointed, not produced in a barblet; interorbital less than the distance between the eyes and the posterior nares; width of head very little less than its length; distance between snout and dorsal 2.25-2.4 in the length; dorsal spine prolonged, equal to head less space in front of anterior nares, the first ray extending beyond tip of next ray, etc.; adipose spine fleshy, bearing a few spinules, its tip usually continuous with the margin of the adipose ridge, a distinct notch behind it, a small membrane attaching the spine to the back, the spine much more rarely absent, the ridge with or without a posterior notch; caudal deeply emarginate, the lobes as long as the head or considerably longer; anal in male with second ray slightly shorter than those in front of or behind it; anal in female with the spine longest, the rays graduate; origin

of the ventrals under or in front of the origin of the dorsal, reaching about three-fourths to the anus, about equal to the length of the head behind the nostrils; pectoral filament nearly as long as the head, reaching a little beyond middles of ventrals.

Colour variable, rarely uniform dark brown, without spots on the fins, sometimes with a variable light margin along posterior half of adipose ridge and a variable light band downward from the adipose spine. In addition, there is a series of individuals with regular modifications from the smallest to the largest; in the smallest are three large light areas, one in front of the dorsal, and one behind it, and one across posterior portion of adipose, with a dark band across the caudal; these light areas become marbled and gradually fade with age, and the caudal becomes spotted.

Rio Comerciato, Urubamba, Peru, 1800 feet (*Edmund Heller*). Type in Mus. Comp. Zool. Paratypes in M. C. Z., Indiana University, and Carnegie Museum. (Described from a MS. account of the fishes of the Rio Urubamba, by the late Dr. Eigenmann. Measurements not given.)

This species is evidently related to *A. trifasciatus* and *A. taczanowskii*.

Named for Ayar Manco, the Moses of the Peruvians, who led the exodus from Tampu-tocco to Cuzco about 1100 A.D.

Loricariidæ.

Ancistrus occloi, E., sp. n.

Eleven or twelve plates between anal and caudal, six or seven between dorsal and spine of the adipose; spiniferous portion of pectoral spine not quite reaching spiniferous part of ventrals; ventrals reaching to near tip of anal. Snout with a double row of tentacles, a few tentacles between the two rows in the middle.

Sides and top of head with obscure light spots about as large as the eye; dorsal rays alternately light and dark; caudal with two irregular light cross-bands; ventrals and pectoral coloured like the dorsal.

Measurements and counts of type (figures in parentheses refer to paratype):—Dorsal 1, 7 (1, 7). Anal 1, 3 (1, 4). Lateral plates 25 (25). Length to base of plates at root of caudal 89 mm. (88 mm.). Head 36 (34). Width of head 33 (33). Depth of head at occipital process 15 (15.5). Interorbital 14 (14). Ramus of lower jaw 9 (9). Snout 22 (24). Orbit 3.5 (3.5). Lower caudal lobe 27 (28). Upper caudal lobe 24 (24). Base of dorsal 18 (18). Distance between dorsal and adipose spine 14 (14). Length of dorsal spine 20 (20). Length of pectoral spine 23 (24). Length of ventral spine 22 (21). Length of caudal peduncle 25 (25). Depth of caudal peduncle 9 (9). Interopercular spines, number, 13 and 14 (15). Longest interopercular spine, length 9 (8).

Ollantaytambo, Rio Urubamba, Peru. 9000 feet (*Edmund Heller*). Type, 115 mm., in Mus. Comp. Zool. Paratype in Indiana University. (Described from a MS. account of the fishes of the Rio Urubamba, by the late Dr. Eigenmann.)

Allied to, if not identical with, *A. bufonius* (= *calamita*) from the Apurimac, at 2000 metres.

Named for Occlo, the august princess, wife of the Ayar Manco.

Characinidæ.

Astyanax hastatus, sp. n.

The specimens to which I apply this name are a variable and perplexing lot, closely related to *A. fasciatus*, but all of them appear to differ from that species in all its varieties in the hastate caudal spot, extending nearly or quite to the upper and lower borders of the caudal peduncle. In most other characters they seem to be near *A. fasciatus jequitinhonæ* (Stdr.), but they surely are not that form. Neither do they exhibit the deflection of the scales of the anal region seen in *A. f. parahybæ*. All are much smaller than the general adult size of *fasciatus*.

As holotype I have chosen an average-sized specimen, 48 mm. in total length. It does not show the extension of the spot on the central caudal rays as well as do most of the others, however. Its description follows:—

Head 3.8. Depth 2.8. Dorsal 11. Anal 24. Eye 2.5 in head, a little greater than interorbital. Scales 6-35-4½. Ten rakers on lower limb of first gill-arch. Great suborbital covering nearly the entire cheek. Five wide five-pointed teeth in the second series on each side of the premaxillary. Two teeth on each side in the first series. A single tooth at upper end of maxillary. Dorsal origin midway between caudal base and snout-tip, a little posterior to pelvics. Pectorals just reach pelvics, which scarcely reach anal. Snout somewhat pointed; jaws equal. Scale-rows regular, no interpolated series. A dark rounded humeral spot, with a suggestion of a fine vertical elongation. A dark lateral streak ending in a hastate caudal spot. Scales not dark-edged.

The twenty-five paratypes (30 to 52 mm.) show many variations. The caudal spot in all is very nearly the same, darker in some, and in all but one or two showing clearly a fine black extension to the tips of the middle rays. Above and below this, basally, there are traces of a pale orange spot on the two or three alcohol specimens. The others were preserved in formaldehyde. The former specimens also show a silvery lateral band over the dark one. In a few the scales towards the back become very faintly dark-edged.

The variation in depth is marked. In the largest specimen it is 2.33, and from this it varies down to that of the type. In the

deepest specimen the transverse scale-rows are 7-1-5½, the middle one signifying the lateral line scale. In another they are reduced to 6-1-4, while still others are 6-1-5. The lateral scales vary from 34 to 36, usually 35. The dorsal seems constantly 11. The anal varies from 23 to 26, usually 24 or 25. There are ten predorsal scales in a complete regular series, apparently constant in all. The extent of the great suborbital varies somewhat leaving a rather considerable naked border. The vertical fins are usually dusted with black chromatophores.

Three other specimens are distinguishable at once by their peculiar appearance, and they may belong to a different species. Their scales are very deep and heavily dark-edged. The scale-count is 5-36-4. The scales swing round so as to become very oblique over the pelvics, and this continues above the anal, although the rows hold their direction and there are no interpolated rows. The anal ray count is low, 20, 21, 22, in the three. The humeral spot in one is rounded, in another horizontally oval, and in the third it shows a tendency to vertical elongation. The caudal spot is darker than in most of the specimens of *hastatus*, but is somewhat more diffuse and less evidently hastate. The head is larger, 3.5. The suborbital leaves a wider margin below than behind. Length 45 to 54 mm.

Whether or not *A. hastatus* may eventually be considered a subspecies of *A. fasciatus*, it certainly seems to be a recognizable form. Aside from the caudal spot, it differs from *fasciatus* in the larger head (I believe the specimens are mature), the lower average scale-count, the narrower interorbital, and the fewer predorsal scales.

All of the specimens were presented to me by Mr. Richard Dorn, who received them as living aquarium fishes directly from Mr. R. Brocca, of Rio de Janeiro. The fishes were said to have been collected in the vicinity of the city, but there is a possibility of their having come from any of a number of places in south-eastern Brazil.

Astyanax scintillans, sp. n.

A very distinct, small, highly iridescent species allied to *A. essequibensis*, from which it differs in the number of scales and anal rays, the position of the dorsal fin, and the lesser size.

Head 4.6 to 4.8. Depth 3.33. Anal 18 to 19. Dorsal 11. Scales 5-31-4. Predorsal 10. Eye 2.5. Interorbital nearly 3.

Predorsal and preventral areas rounded, each with a median regular series of scales. Scales all regularly set; no interpolated rows in anal region. Body well compressed but not greatly so, the greatest thickness 2.33 in depth.

Great suborbital covering entire cheek, except for a very small area at the upper posterior corner. Opercle excised above, similarly to *A. essequibensis*, but to a greater extent. This emargination or notch, seen to a greater or lesser extent throughout the genus,

is better developed in *scintillans* than in any other. Premaxillary with two or three small teeth in the first series on each side; five 3- to 5-pointed teeth in the inner series on each side. One small tooth at upper limit of maxillary. In the mandible the second tooth from the middle on each side is set down and a little forward, so that the front four teeth are nearly in a straight series across the front. The next (and last) two large teeth on each side are set higher and swing backward, followed abruptly by very fine teeth.

Dorsal origin midway between snout-tip and caudal base or very slightly nearer the former. Pelvic fins under or a little anterior to dorsal origin. Pectorals not reaching pelvics by one scale. Anal emarginate.

Scales and head-plates gorgeously iridescent silvery, much more so than the ordinary *Astyanax*, and approaching the condition seen in *Creatochanes*. The silvering is so heavy that it obscures other body-colours, the sides appearing leaden when not reflecting. It can be seen, however, that there is a darker, wide, plumbeous lateral band, from upper end of gill-slit to caudal base, but no humeral or caudal spots are discernible. Fins all clear.

Playa Matepalma, Rio Orinoco, Venezuela, April 2, 1925 (*Dr. Carl Ternetz*). Types, two specimens, 28 mm. (36 mm. total) and 29 mm. (38 mm. total) in length. Types in Indiana University.

This gloriously beautiful little fish is one of the most distinct in the genus. It has been directly compared with paratypes of *A. essequibensis*, the most closely related species, from which it differs widely in several characters.

Bryconamericus ternetzi, sp. n.

Head 4.4. Depth 3.1. Dorsal 9½. Anal 18. Scales 4½-36-3½. Eye 2.4 in head. Interorbital 2.8.

Mediumly heavy-set, well compressed, deepest at dorsal origin, greatest thickness 2.2 in depth. Orbit obliquely oval. Lower jaw slightly included. Preventral area rounded, postventral rather sharp, squamation normal. Predorsal area rounded, with a median series of eight scales, a distance equal to two others naked.

Occipital process short. Skull smooth and but little convex in transverse section; frontal fontanel triangular, small; parietal fontanel much larger. Cheek not very deep, the great suborbital covering the entire cheek, touching the preopercular suture, angle, and lower limb, leaving a slight naked area only far up near the first postorbital.

Maxillary-premaxillary border forming a rather abrupt angle, as is common in the Tetragonopterinae. None of the maxillary curve is concave, all convex. Four 5-pointed teeth in the inner series of the premaxillary on each side. An outer series composed of five small teeth on each side, three set forward and the two alternate ones set back a little. Maxillary with three tricuspid

teeth crowded to its upper end. Five graduated 5-pointed teeth on each side in the dentary, the third one somewhat raised, canine-like. Following these are four or five very small tricuspid teeth. Tips of all teeth brown.

Nine rakers on lower limb of first gill-arch.

Scales thin, the only two radii present delimiting the visible sector of the scale; regularly imbricate with no interpolated rows over the anal. An anal sheath of a single series of small scales over the base of the first two-thirds of the fin.

Dorsal origin exactly midway between snout-tip and caudal base, slightly posterior to vertical of pelvic fin origin. Pectorals do not reach pelvics by one or two scales. Pelvics reach anus, but not anal fin. Anal fin inserted just posterior to vertical of base of last dorsal ray.

Silvery, scales of back dark-edged. A pale, diffuse, silvery lateral band, nearly lost in the silver of the sides. A faint vertical humeral blotch. No caudal spot. Fins shaded with dusky.

Very near *B. deuterodonoides* and its allies, differing, among other things, in depth and dentition.

Camanáos Rapids, Rio Negro, Brazil (*Dr. Carl Ternetz*). Type, 59 mm. (total), in Indiana University.

The description is drawn up in the style of those in Dr. Eigenmann's 'The American Characidae,' in order to make it easier of comparison with those of the numerous very closely related species. The irregularity of the first series of premaxillary teeth, together with the included lower jaw and oval orbit, would easily lead one, not well acquainted with these fishes, to place the present species in *Creagrutus*, especially while working with Eigenmann's generic key. The dentition is, however, the typical one of *Bryconamericus*, as seen in the genotype, *B. exodon*, and differs widely from the massive teeth of *Creagrutus*.

PIABARCHUS, gen. nov.

Genotype: *Piabina analis*, Eigenmann.

The species described by Dr. Eigenmann as *Piabina analis* (Indiana Univ. Studies, No. 19, 1914, p. 8) from São Luis de Cáceres, Upper Rio Paraguay, differs from all known species of *Piabina* in the long, anteriorly-inserted, anal fin. *Piabina* is scarcely separable from *Creagrutus*, having the same massive dentition. Although I have not examined the unique type of *analis* in the Carnegie Museum, it is apparent from Eigenmann's figure (Mem. Mus. Comp. Zool. xliii. pl. lxxxix. fig. 2) that the fish greatly resembles certain species of *Bryconamericus*, as indeed Dr. Eigenmann mentions in the description. It may also be remembered what I have said above concerning the dentition of *Bryconamericus ternetzi*. It may well be that *Piabarchus analis* is closer to this genus than to *Piabina*, but its anal fin well distinguishes it from either.

IX.—*New Species of Parhestina* (Lep., Nymphalidæ).
By H. T. G. WATKINS.

Parhestina ouvrardi, sp. n.

When de Nicéville, on May 22, 1879, took on the forest-clad road between Chamba and Kujiar in the N.W. Himalaya the first (and still unique) specimen of the *Parhestina* subsequently described and figured by Moore as *P. nicevillei**, he was "at once struck that it was an excellent mimic, both in the slow and sailing mode of its flight and in general appearance," of *Aporia agathon caphusa*, so common in these outer ranges of the west. Similarly, when, further to the east in the same mountains, Col. T. Jermyn, on June 19 and 25, 1907, took in the Tons Valley behind Chakrata near Masuri his two specimens of another and quite distinct species—*P. jermyni*, H. H. Druce †—his first was taken in company with *Aporia phryxe*, which it much resembles, the second was only known not to be an *Aporia* by its solitary and more sustained flight.

There has now come with the Oberthür Collection to the British Museum yet another species, represented again by only two individuals, which Oberthür himself recognized as new ‡ and proposed to describe in vol. xviii. of his 'Études de Lépidopterologie Comparée' with other butterflies from the same source, but somehow omitted to do so. He had received it from the missionary Père Ouvrard, stationed at Weisi on a tributary of the Mekong in N.W. Yunnan, and had also a second specimen from some other source—probably purchased,—which bears a numeral and is labelled in pica print "Tali, Haut Yunnan."

It is a close mimic of *A. agathon agathon* (which appears to be as common in Yunnan as in the E. Himalaya), and may be described as follows:—

♂. Fore wing with termen convex at vein 2, concave between 3 and 4, thence rounded to apex; black, with the following greenish-white markings:—whole of cell and a little beyond it, more than half cellule 1 *b* from base, the centre of cellules 2 and 3, these joining a curved transverse median row of spots of which the subcostal one is largest; a free postmedian row of small spots not reaching costa, and traces of a minute subterminal row.

* Lep. Ind. iii. p. 37, pl. ccii. figs. 2, 2A (1897).

† Trans. Ent. Soc. Lond. 1911, p. 187, pl. xxix. fig. 1; cf. Jermyn, *ibid.* 1917, Proc. p. xi.

‡ Bull. Soc. Ent. Fr. 1920, p. 203.

Hind wing similar, the spots less diffuse, more sharply defined; costal area, cell, basal half of cellules 5 and 6, the whole of 1 *a*, and most of 1 *b* white; postmedian spots large in 5 and 6; minute subterminal spots distinct in 2 to 5.

Underside as above, but ground-colour duller, pale areas more bluish white; hind wing with dorsum and precostal areas light yellow, spots at bases of 7 and 8 faintly tinted with yellowish.

Head, palpi, and antennæ black, proboscis yellow; thorax dark grey, with greyish-white hairs, patagia whitish; abdomen black, shading to grey on sides, beneath whitish with black lateral stripe as in *P. mena*; legs greyish barred with black.

Exp. 84–90 mm.

N.W. Yunnan: Weisi (type), Tali (paratype).

Judging from Moore's figure of *nicevillei*, it and *ouvrardi* may quite possibly prove eventually to be conspecific, the greater extent of pale markings in the former corresponding to those in the particular *agathon* race it copies.

Collectors who have the opportunity in either region might well pursue any "Aporias" which show exceptional activity rather than those which are easy to net, the females of these three great rarities being at present all unknown.

Parhestina waterstradti, sp. n.

♂. Fore wing with termen concave at vein 3, rounded above and below, dark fuscous, with dull greenish-white markings in lower half of cell, basal half of cellules 1 *b* and 2, base of 3, and as spots in 4 and 5 at end of cell; rest of cell, base of 5, and an irregular transverse postmedian band dull tawny; a curved discal series of six rather large greenish-white spots, those in 6, 5, and 2 the largest, that in 1 *b* the smallest, that in 3 advanced proximally; a series of nine small subterminal spots.

Hind wing similar, the greenish markings longer, whole of cellules 1 *a* and 1 *b* pale except along vein 1 *a*, the tawny areas confined to the centres of 2 and 3; discal spots smaller, that in 3 minute; subterminal spots larger, lunular, that in 1 *c* double; fringes white between the veins.

Underside as above, but all markings less distinct, as if faded; area 1 *b* of hind wing brown.

Head dark fuscous with yellow spot on frons, palpi yellow beneath, proboscis orange, antennæ fuscous, club reddish beneath; thorax with yellow spot on tegulæ, the patagia

whitish; abdomen yellowish beneath, with narrow dark fuscous lateral stripe; legs yellowish.

Exp. 84 mm.

Described from a single specimen ex Oberthür Coll. with the printed label "Mindanao, J. Waterstradt, 1903-1904," but the locality is, perhaps, open to doubt, as Waterstradt collected in other places as well, and the model appears to be *Danaida affinis* in such races as *sangira* or *decentralis* rather than *D. plexippus* or *D. melanippus*.

Type B.M.

X.—*Descriptions of Five new Cichlid Fishes of the Genus Haplochromis from Lake Victoria.* By ETHELWYNN TREWAVAS, B.Sc.

A LARGE collection of fishes from Lake Victoria made by Mr. Michael Graham has been received at the Natural History Museum; it contains examples of five new species of *Haplochromis*, which are described below. The collection also includes large series of some of the species described by Regan (P. Z. S. 1922, p. 157), which are more variable than would appear from his descriptions, particularly *H. guiarti*.

Haplochromis michaeli, sp. n.

Depth of body $2\frac{3}{4}$ in length, equal to length of head. Snout decurved, slightly longer than diameter of eye, which is 4 in length of head, equal to depth of cheek and greater than depth of preorbital; interorbital width $3\frac{1}{2}$ in length of head. Lower jaw projecting; maxillary extending to below anterior $\frac{1}{4}$ of eye; teeth small, conical, 4 series in upper jaw, 3 in lower, about 70 in outer series of upper jaw. 3 or 4 series of scales on cheek. 9 gill-rakers on lower part of anterior arch. Pharyngeal teeth slender. 32 or 33 scales in a longitudinal series, 5 or 6 from origin of dorsal to lateral line. Dorsal XV 10; last spine a little less than $\frac{1}{3}$ length of head. Anal III 8-9; third spine shorter than last dorsal. Pectoral $\frac{8}{10}$ length of head, reaching origin of anal. Caudal truncate. Caudal peduncle $1\frac{1}{2}$ as long as deep. A dark opercular spot and a dark longitudinal band from this to caudal; fins pale; soft dorsal with a few spots; male with black pelvics, and ocelli on anal.

Two specimens, 158 and 175 mm. in total length.

This species is intermediate between *H. guiarti* and *H. martini*.

Haplochromis maxillaris, sp. n.

Depth of body $2\frac{1}{2}$ to 3 in length, length of head 3 to $3\frac{1}{2}$. Upper profile of head slightly concave; snout from a little shorter (young) to a little longer than diameter of eye, which is $3\frac{1}{2}$ to 4 in length of head, equal to or greater than depth of cheek, about twice depth of præorbital; interorbital width 4 to $4\frac{1}{2}$ in length of head. Mouth oblique; lips rather thick; maxillary strongly exposed, extending to below anterior part, or sometimes nearly to middle of eye. Teeth small, conical, in 3 series; about 40 in outer series of upper jaw. 2 to 4 series of scales on cheek. 10 or 11 gill-rakers on lower part of anterior arch, the posterior ones expanded as in *H. microdon*. Pharyngeal teeth slender. 30 or 31 scales in a longitudinal series, 4 to 6 between first dorsal spine and lateral line. Dorsal XV-XVI 8-9; last spine $\frac{1}{2}$ to $\frac{1}{2}$ length of head. Anal III 8-9, third spine stronger but shorter than last dorsal. Pectoral as long as head, or nearly, reaching anal. Caudal truncate. Caudal peduncle $1\frac{1}{4}$ to $1\frac{1}{2}$ as long as deep. Greyish or brownish, darker above, with more or less distinct cross-bars and an interrupted lateral band.

Nine specimens, 91 to 168 mm. in total length.

This species is closely related to *H. microdon*, differing especially in the larger mouth, more exposed maxillary, and narrower præorbital.

Haplochromis gowersii, sp. n.

Depth of body $3\frac{1}{2}$ in length, length of head $2\frac{3}{4}$. Snout as long as postorbital part of head; diameter of eye 6, interorbital width $5-5\frac{1}{2}$ in length of head; depth of præorbital greater than diameter of eye; depth of cheek $1\frac{1}{2}$ diameter of eye. Mouth oblique; lower jaw strongly projecting; maxillary not extending to below eye; teeth conical, in 4 series in upper jaw, 3 in lower; anterior teeth of outer series strong. 4 to 6 series of scales on cheek. 8 or 9 gill-rakers on lower part of anterior arch. Pharyngeal teeth small. 32 or 33 scales in a longitudinal series, 5 or 6 from origin of dorsal fin to lateral line. Dorsal XVI 9, last spine $\frac{1}{2}-\frac{2}{3}$ length of head. Anal III 9-10, third spine as long as last dorsal. Pectoral $\frac{3}{4}$ length of head, not reaching anal. Caudal subtruncate, caudal peduncle $1\frac{1}{3}-1\frac{1}{2}$ as long as deep. An opercular spot and a dark lateral band; dorsal and caudal greyish, lower fins pale.

Two specimens, 180 and 195 mm. in total length.

This species is probably most nearly related to *H. mento*, but differs in the more oblique mouth and deeper cheek.

Named in honour of Sir William Gowers, K.C.M.G., Governor of Uganda, in recognition of the help given by him to Mr. Graham.

Haplochromis melanopterus, sp. n.

Depth of body 3 in length, length of head $3\frac{1}{4}$. Snout as long as eye, the diameter of which is $3\frac{2}{3}$ in length of head, twice præorbital depth, equal to depth of cheek; interorbital width $3\frac{1}{3}$ in length of head. Mouth oblique; lower jaw shutting within upper; maxillary exposed, extending to below eye. Teeth conical, in 2 or 3 series, outer stout. 4 series of scales on cheek. 10 gill-rakers on lower part of anterior arch. Pharyngeal teeth small. 33 scales in a longitudinal series, 7 from origin of dorsal to lateral line. Dorsal XV 9; last spine $\frac{2}{3}$ length of head. Anal III 8; third spine $\frac{1}{3}$ length of head. Pectoral as long as head, not quite reaching anal. Caudal rounded. Caudal peduncle $1\frac{1}{3}$ as long as deep. Brownish; vertical and pelvic fins blackish.

A single specimen, 160 mm. in total length (Station 53).

Closely related to *H. obesus*, which it resembles in dentition and in the structure of the mouth. It is distinguished by the more elongate form and narrower interorbital region.

Haplochromis obtusidens, sp. n.

Depth of body $2\frac{1}{3}$ – $2\frac{1}{2}$ in length, length of head $2\frac{1}{4}$. Snout decurved, a little longer than eye the diameter of which is $3\frac{2}{3}$ in length of head, greater than depth of præorbital or cheek, equal to interorbital width. Jaws equal; maxillary extending to below anterior quarter of eye. Teeth in 4 or 5 series in upper jaw, 3 or 4 in lower; outer mostly bicuspid, about 70 in outer series of upper jaw. 3 or 4 series of scales on cheek. 9 or 10 gill-rakers on lower part of anterior arch. Lower pharyngeal a somewhat massive plate, with large blunt teeth, and with numerous small teeth near the posterior angles. 30–31 scales in a longitudinal series, 5 from origin of dorsal to lateral line. Dorsal XV 9, last spine $\frac{2}{3}$ length of head. Anal III 9, third spine stronger than last dorsal, $\frac{1}{3}$ length of head. Pectoral nearly as long as head, reaching anal. Caudal truncate. Caudal peduncle longer than deep. Irregular dark cross-bars on body; pelvic fins blackish.

Two specimens, 130 mm. in total length.

Related to *H. cinereus* and *H. ishmali*. The lower pharyngeal is somewhat smaller than in *H. ishmali*, and bears more numerous teeth, especially towards the posterior angles.

XI.—*Notes on Reptiles and Batrachians from Matto Grosso and E. Bolivia.* By H. W. PARKER, B.A.

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THE British Museum has recently received collections from the Department of Sta. Cruz, Bolivia (collected by Señor J. Steinbach), and from Matto Grosso (collected by Mr. C. L. Collenette). Certain sections of the first-mentioned collection have already been reported upon *, and, as the fauna of the two regions is so similar, further notes on species in that collection are offered with notes on some of the species in the second collection. The author desires to express his indebtedness to Mr. Collenette, who has on more than one occasion exhibited the greatest kindness in collecting material for him.

LACERTILIA.

1. *Gonatodes humeralis* (Guichen.).

One male from Urucum, near Corumba, Matto Grosso. This appears to be the most southerly record for this species.

2. *Ameiva ameiva læta*, Cope.

Thirteen specimens from Buenavista, Bolivia, and one (♀) from Cuyaba.

The colour-pattern of the adults of this series is not typical, but agrees with that of the specimen from Goyaz, Brazil, described by Barbour and Noble †, and may be regarded as an approach to *A. a. petersii* (Cope).

3. *Bachia d'orbignyi* (Dum. & Bibr.).

Ophiognomon trisanale (non Cope), Procter, Ann. & Mag. Nat. Hist. (9) vii. 1921, p. 189.

Twenty-five specimens from Buenavista.

The number of transverse rows of scales may be as low as forty-eight, and occasionally the median dark stripe on the back may be indistinct or absent.

* Parker, Ann. & Mag. Nat. Hist. (9) xx. 1927, p. 450, and Occ. Pap. Mus. Zool. Michigan, 187 (1927).

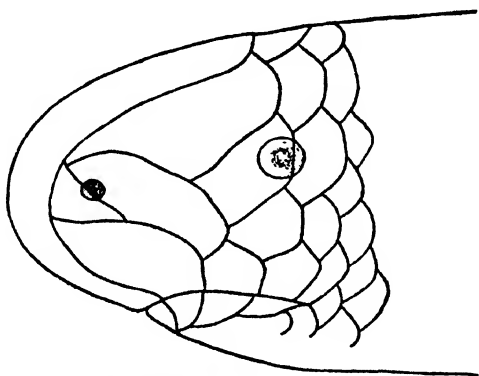
† Bull. Mus. Com. Zool. Harvard, lix. 6, 1915, p. 468.

OPHIDIA.

4. *Helminthophis collenettei*, sp. n.

Type-specimen no. 1927. 1. 12. 1 in the British Museum from Burity (30 miles N.E. of Cuyaba), Matto Grosso, collected 8. vii. 27 by Mr. C. L. Collenette.

Snout obtusely rounded. Rostral about half the width of the head, not extending posteriorly quite to the level of the eyes, rounded posteriorly and broadly in contact with the frontal, which is nearly three times as broad as long; one subocular; two superposed præoculars; eye indistinct, almost



Helminthophis collenettei, sp. n.

entirely beneath the upper præocular; four upper labials, the first largest, second in contact with the nasal and the lower præocular, third in contact with the lower præocular and the subocular, fourth small and also in contact with the subocular. Tail longer than broad and ending in a short spine. Twenty scales round the body. Brown above, lighter beneath.

Total length 93 mm.; diameter 2 mm.; tail 3 mm.

This species is very closely allied to *H. ternetzi*, Boulenger, from Paraguay, from which it differs in having twenty instead of twenty-two scale-rows, a slightly larger præocular, and in lacking a light head.

5. *Leimadophis* [*Liophis*] *typhlus* (Linn.).

Liophis guentheri, Peracca, Boll. Mus. Torino, xii. 1897, no. 274, p. 11.

Two specimens from Buenavista and one from Urucum.

Ann. & Mag. N. Hist. Ser. 10. Vol. ii.

Comparison of these specimens with a paratype of *Liophis guentheri*, Peracca, and with the series of *L. typhlus* in the British Museum fails to reveal any consequential difference between the two species.

6. *Apostolepis borelli*, Peracca.

Two males and one female from Buenavista.

Sc. 15; ventrals 214, 211, 204; subcaudals 29, 31, 28.

This species does not appear to have been previously recorded from Bolivia, and the three specimens exhibit some differences from the type. In all of them the white spot, which Peracca describes as being present on the fourth upper labial, extends also on to the third, fifth, and sixth. In one of the males (ventrals 214) only one upper labial is in contact with the parietal, the sixth being separated by an anterior temporal; the other male, however, agrees with the original description in having the sixth upper labial in contact with the parietal, but, in addition, the fourth is also just in contact with this shield.

SALIENTIA.

7. *Hyla spegazzini*, Boulenger.

Hyla goodfellowi, Procter, Ann. & Mag. Nat. Hist. (9) vii. 1921, p. 191.

Hyla boans (in part.), Mir.-Ribeiro, Arch. Mus. Nac. Rio Janeiro, xxvii. 1926, p. 84, pl. vii. fig. 3.

Two specimens from Urucum, one from Cuyaba, and three from Sta. Cruz, Bolivia.

Comparison of the type-specimens of *H. spegazzini* and *H. goodfellowi* fails to reveal any differences which warrant their being maintained as distinct. Miranda-Ribeiro (*loc. cit.*) appears to have confused this species with the following, the description embracing the colour-pattern of both, and the figure being definitely that of a specimen of *H. spegazzini*.

The two species may be recognized as follows:—

- | | |
|---|-----------------------------------|
| A. Toes slightly more than $\frac{2}{3}$ -webbed, hinder side of thighs with vertical dark bars; no white line above the vent. | <i>H. spegazzini</i> , Boulenger. |
| B. Toes only $\frac{1}{2}$ -webbed, hinder side of thighs dark with numerous white spots; a white line above the vent. | <i>H. boans</i> , Daudin. |

8. *Hyla boans*, Daudin.

Two specimens from Burity (30 miles N.E. of Cuyaba).

Hyla guentheri, Boulenger, which Miranda-Ribeiro (*loc. cit.*) considers to be a synonym of this species, is quite definitely

distinct, and may be recognized by the following differences:—Vomerine teeth in two small rounded groups; snout much shorter, scarcely longer than the diameter of the orbit; hind limbs shorter, the tibio-tarsal articulation not extending beyond the anterior border of the eye; much smaller size, an adult male measuring only 28 mm. from snout to vent and a female 40.

9. *Leptodactylus mystaceus* (Spix).

Leptodactylus longirostris (non Boulenger), Procter, Ann. & Mag. Nat. Hist. (9) vii. 1921, p. 191.

Eight specimens from the provinces of Sara and Sta. Cruz, Bolivia, agree with the Bolivian specimen recorded by Miss Procter as *L. longirostris*, but should, apparently, be referred to *L. mystaceus* (Spix).

XII.—A new Subspecies of Bush-Pig.

By G. F. PINFOLD, Powell-Cotton Museum.

THE following is a description of a new subspecies of *Potamochoerus chæropotamus* obtained by Major P. H. G. Powell-Cotton in Angola:—

Potamochoerus chæropotamus cottoni, subsp. n.

General colour on back pale rufous blending into black on sides and legs. Dorsal crest commencing between the ears and ending at base of tail, whitish slightly mingled with brown on fore part, and becoming black mixed with a few white hairs on the rump; small whitish patch on either shoulder; muzzle light brown, no black ring in front of tuberosities as in *chæropotamus*; forehead whitish, black band extending across frontal between eyes; ears large, with long tufts of black hair at tips. Usual tuberosities, but the two upper ones well developed, resembling large conical warts. Tail brown, very sparsely covered with hair; black tuft at tip.

Skull-measurements:—

	mm.
Basal length	342
Width	184
Width across tuberosities	102
Width across flat portion of parietal region....	22

Type. Adult ♂ mounted and skull in the Powell-Cotton Museum, Quex Park, Birchington, E. Kent. Shot by Major P. H. G. Powell-Cotton at Tunda, Quanza District, Angola, on 20th February, 1922, and numbered Field No. 129.

XIII.—*A remarkably coloured Squirrel from N. Siam.*

By OLDFIELD THOMAS.

THE British Museum has been presented by Prof. T. D. A. Cockerell with two unusually coloured squirrels from N. Siam, belonging apparently to two different species. One of them is so completely different from anything known that I now describe it; the other is more doubtful, and, in the hope of getting further material of it, I propose to leave it for the present.

Callosciurus cockerelli, sp. n.

A rather small squirrel, with bright rufous back, grey sides, and white belly.

Size rather less than in *ferrugineus* and its allies. General colour of upper surface—that is to say, of the dorsal area (not of the sides)—bright ferruginous (Ridgway) from the crown between the ears to the rump; a few irregularly scattered hairs whitish. Sides—i. e., cheeks, shoulders, flanks, and hips—grizzled grey (“neutral grey”). Whole under surface and inner sides of limbs sharply defined white, the belly with a slight and unimportant vinaceous tinge. Hairs of face whitish with ferruginous tips, this mixed colour changing on the crown to the rich ferruginous of the nape and back. Ears white on their edges and hinder surfaces. Limbs, from shoulders to hands, hips to feet, grizzled grey externally; their inner surfaces white to the wrists and ankles. Tail mixed reddish and white proximally, the hairs white at base, red terminally; terminal half of tail completely white, of a slightly yellowish shade, the hairs wholly of this colour.

Skull without special peculiarities.

Dimensions of the type (measured on a re-made skin):—

Head and body 205 mm.; tail 220; hind foot 48.

Skull: greatest length 53; condylo-incisive length 48; zygomatic breadth 30; upper cheek-teeth, exclusive of p^3 , 10.

Hab. N. Siam. Type from near Nan.

Type. Young adult. B.M. no. 28. 5. 5. 2. Shot January 1928 by the Rev. Homer Wiesbecken, and presented by Prof. T. D. A. Cockerell.

This squirrel is so peculiarly coloured and so unlike anything known from Indo-China that I am at a loss to say to what known species it is most nearly related. It may be connected with some of the variegated forms of the *ferrugineus* or

sladeni groups, but its white tail and white belly are quite distinctive of it as a special species.

I have much pleasure in naming it after its donor, Professor Cockerell, who has been a friend and correspondent of the British Museum for so many years.

XIV.—*The South Tenasserim Race of Paguma leucomystax*,
Gray. By OLDFIELD THOMAS.

IN 1915 * Mr. Wroughton recorded in his Tenasserim Report five palm-civets from Bankachon, S. Tenasserim, as *Paguma leucomystax robusta*, Mill.—a determination for which, I believe, I am responsible. Now, however, thanks to the kindness of Mr. H. C. Robinson, I have been able to re-examine the Bankachon specimens with the help of several palm-civets undeniably referable to *robusta*, and find that they represent quite a different race, more like the dark Malayan *leucomystax leucomystax* than the light-coloured *robusta* of Trang and other parts of peninsular Siam. This Tenasserim race might be described as

Paguma leucomystax janetta, subsp. n.

General colour far darker than in the pale *robusta*, and nearly as dark as in typical *leucomystax*. Body-colour, however, quite without the deep coppery suffusion found in *leucomystax*, being dark olivaceous grey, darkening to black on the nape, where the hairs are forwardly directed, and inclined to form a more definite median crest than in the other races. Under surface dull greyish white, little different from that of *robusta*, while in *leucomystax* it is coppery brown. Muzzle brown; cheek-patch white; back of ears black. Arms and legs grey, darkening terminally to black. Tail like back proximally, darkening to black terminally.

Skull about as in *leucomystax*. Teeth comparatively small, but there is considerable variation in this respect among the different specimens of *leucomystax*.

Dimensions of the type :—

Head and body 660 mm.; tail 355; hind foot 110; ear 42.

Skull: condylo-basal length 125; zygomatic breadth 75; length of p^4 on outer edge 9.3.

Hab. Bankachon, Victoria Province, S. Tenasserim.

Type. Old male. B.M. no. 14.12.8.111. Original number 4482. Collected 12th December, 1913, by Capt. G. C. Shortridge. Presented by the Bombay Natural History Society.

This northern race of *leucomystax*—the only one which penetrates into British territory—is separated geographically by the pale *robusta* of peninsular Siam from the dark coppery *leucomystax* of the Malay Peninsula and islands. It is readily separable from the former by its dark olivaceous back and black nape, and from the latter by its pale under surface and the absence of the coppery tone so marked in *leucomystax*.

I may note that no. 42.1.19.99 (♀) is the type-specimen of Gray's *P. leucomystax*. He saw and described it while it was still at Leyden, and then purchased it through the dealer Leadbeater in 1842.

Paradoxurus ogilbyi, Fraser, is clearly the true *leucomystax*.

XV.—*A new Species of Sphegidae from Columbia.*
By L. EVELYN CHEESMAN, F.E.S., F.Z.S.

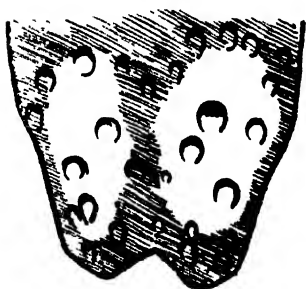
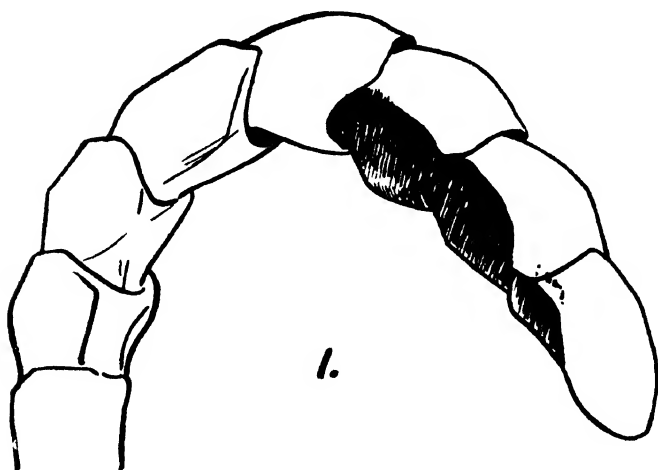
Monedula gorgonensis, sp. n.

Robust; black, with pale cream markings.

♂. Pale cream coloration as follows:—orbital margins, the outer very narrow, the inner extending from lower than antennæ to above fore ocellus; wedge-shaped central fasciæ on clypeus, the upper angle drawn out to a fine point not reaching antennæ, sides extended in a transverse band along the apical margin; lateral longitudinal fasciæ of labrum about the same width as the black central area; basal two-thirds of mandibles on the upper side except a small triangular mark at the base; narrow lateral stripe to antennal scape; stripe on inner side of anterior femora and tibiæ and a small triangular mark near base of outer calcar; irregular transverse band at apex of intermediate femora, and a small fascia on outer side of tibial apices; small elongate fascia on underside of posterior femora; on the abdominal tergites the coloured bands are broken, forming two pairs of fasciæ, the lateral of irregular form, and a pair of discal spots which are absent on the first tergite; sternites 2–5 with lateral triangular fasciæ diminishing in size towards the apical segments.

♀. Pale cream coloration as follows:—orbital margins,

the inner not extending to above the fore ocellus ; transverse fasciæ on clypeus forming an undulating border to the apical margin ; lateral fasciæ on labrum shorter than in ♂ ; mandibles as in ♂ ; apical margin of antennal scape narrowly, beneath ; inner margin of anterior femora and tibiæ and



1. *Monedula gorgonensis*, sp. n., ♂, antenna.
2. Ditto, seventh tergite.
3. *Monedula punctata*, ♂, seventh tergite.

a small spot at base of second tarsal segment on outer side ; small spot at apex of intermediate tibiæ on inner side ; abdomen as in ♂, but a pair of minute discal spots on first tergite, and lateral fasciæ absent on fifth sternite.

♂. Head with tufts of long silvery hair on the vertex; eyes bare; fore ocellus normal, round. Antennæ as in *M. punctata* (fig. 1). Thorax shining, with dense fine punctation interspersed with finer punctures; on metanotum and scutellum less dense and without the finer punctures; propodeon with punctures of both grades irregularly placed. Short, erect, dark brown hair covering the dorsum, replaced by silvery hair on the propodeon, pleuræ, and underside of thorax, scattered over the rest of the body. Mesonotum with a broad, roundly produced, median carina, extending backwards from near the apical margin halfway to the base. Seventh abdominal tergite with sparse coarse punctures apically, apex narrowly emarginate, apical angles broadly obtuse; second sternite with a median carina strongly produced at the base. Sixth sternite furnished with a stridulatory organ (described by Strand, Zool. Jahrb. xxix. p. 147, 1910) as long as wide. Intermediate femora armed with a curved reflexed spine as in *punctata* and others of that group.

♀. Sixth tergite very coarsely aciculate-punctate, with median carina.

Belongs to Handlirsch's first group (Sitzber. Akad. Wiss. Wien, xcix. pts. i.-iii. p. 85, 1890). Near *M. punctata*, but differs in the form of seventh tergite in the male, the apical angles of which are more obtuse and the emargination less deep and more angular (fig. 2), and in the surface-sculpture of sixth tergite in female, as well as in coloration in both sexes.

Long., ♂ 28 mm., ♀ 23.5 mm.

Type and paratype in British Museum.

Island of Gorgona, S.W. Columbia, 1 ♂, 1 ♀, taken on blossoms (*L. E. C.*). 'St. George' Expedition, July 1924.

XVI.—*Two new Fishes from Lake Victoria.*

By J. R. NORMAN.

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THE fishes described below form part of a collection made by Mr. Michael Graham during his recent fishing survey of Lake Victoria, and presented by him to the British Museum (Natural History). In addition to the two new species, the collection includes four examples of *Gnathonemus macrolepidotus*, Peters, a species not hitherto recorded from the Lake, and ten examples of *Barbus radcliffei*, Boulenger, which proves to be identical with *B. lobogenys*, Boulenger.

Marcusenius grahami, sp. n.

Depth of body $2\frac{3}{4}$ to a little more than 3 in the length, length of head 4 to $4\frac{1}{2}$. Head as long as deep or a little deeper than long, $1\frac{3}{4}$ to $1\frac{1}{2}$ times as long as broad; snout about $\frac{1}{2}$ length of head, rounded, projecting well beyond mouth; width of mouth $4\frac{1}{4}$ to $4\frac{1}{2}$ in length of head; angle of mouth below anterior margin or anterior part of eye; teeth bicuspid, truncate when worn down, 5 in upper jaw, 5 or 6 in lower; nostrils on a line with lower border of eye, nearer latter than end of snout; eye moderate, as long as or a little longer than snout, about $\frac{2}{3}$ interorbital width. Dorsal 29–31; shorter than its distance from head. Anal 23–26; origin below fourteenth to sixteenth ray of dorsal, a little nearer base of caudal than root of pelvic. Pectoral pointed, subfalcate, nearly as long as head, $1\frac{3}{4}$ to $1\frac{1}{2}$ times length of pelvic and extending beyond base of latter. Caudal with pointed lobes. Caudal peduncle $2\frac{1}{2}$ to 3 times as long as deep, much shorter than head. 62 to 69 scales in lateral lines, 12 or 13 between anterior part of dorsal fin and lateral line, 12 round caudal peduncle. Dark brownish above, silvery white below, with or without some irregular darker markings.

Described from seven specimens, 135 to 155 mm. in total length, from near the mouth of the Kagera River ($0^{\circ} 57\frac{1}{2}'$ S., $31^{\circ} 46\frac{1}{2}'$ E.).

Closely related to *M. discorhynchus*, Peters, and *M. petherici*, Boulenger. It differs from the former in the somewhat deeper body, larger head, wider and more inferior mouth, and the shorter caudal peduncle; it may be distinguished from the latter chiefly by the greater distance between the dorsal fin and the head and by the smaller number of dorsal rays.

Clarias eupogon, sp. n.

Depth of body $6\frac{1}{2}$ in the length, length of head $4\frac{3}{4}$. Head $1\frac{1}{2}$ times as long as broad, smooth above; occipital process acutely pointed, longer than broad; frontal fontanelle about twice as long as broad; occipital fontanelle small, extending on occipital process; eye small, about $2\frac{3}{4}$ times in length of snout, $5\frac{1}{2}$ in interorbital width, which is about equal to width of mouth and a little less than $\frac{1}{2}$ length of head; band of premaxillary teeth $3\frac{1}{4}$ times as long as broad; vomerine teeth conical, forming a curved band which is about as broad as the premaxillary band; nasal barbel twice as long as head, nearly reaching tip of pelvic when laid back; maxillary barbel $2\frac{1}{2}$ times length of head, extending nearly to middle of

dorsal fin; outer mandibular barbel more than $1\frac{1}{2}$ times length of inner, which is nearly as long as head. Gill-rakers moderate, 15 (?) on lower part of anterior arch. Clavicles hidden under the skin. Dorsal about 80; its distance from occipital process about $\frac{1}{4}$ length of head. Anal 62. Dorsal and anal in contact with caudal, but not adnate to that fin. Pectoral $1\frac{1}{2}$ in length of head, the spine more or less serrated on both sides, and about $\frac{4}{5}$ length of fin. Pelvics $1\frac{3}{4}$ times as distant from caudal as from end of snout. Caudal more than $\frac{1}{2}$ length of head. Olive-brown above, lighter below.

Described from a single specimen, 150 mm. in total length, from Lake Victoria ($0^{\circ} 22' S.$, $34^{\circ} 14' E.$).

Close to *C. alluandi*, Boulenger, differing chiefly in the much longer nasal and maxillary barbels and in the longer pectoral spine.

XVII.—*Drei neue asiatische Heteroceridae (Coleoptera) im British Museum.* Von RICHARD MAMITZA, Wien.

Heterocerus (Littorimus) micans, sp. n.

Etwas mehr als $2\frac{1}{2}$ mal länger als breit, schwarz, ohne Spuren von Makeln, auffallend durch den erzschrimmernden Glanz der Oberseite.

Kopf etwas breiter mit den Augen als lang mit den Mandibeln, fein und dicht gelb behaart. Stirn gewölbt, Oberlippe $1\frac{1}{2}$ mal breiter als lang, viereckig, mit abgerundeten Vorderwinkeln. Kiefer- und Lippentaster gelb, Fühler gelb, elfgliedrig mit siebengliedriger Keule. Die Spitze der Mandibeln scharf und dünn, die auf der Innenseite gelegenen drei Zähne abgerundet, stumpf.

Halsschild doppelt so breit als lang, so breit wie die Flügeldecken, Vorderecken stark abgerundet, Seiten parallel, Basis gegen die Hinterecken jederseits schräg abgestutzt, vollständig bis zu den Hinterwinkeln fein gerandet, diese deutlich ausgeprägt. Fein und dicht punktiert, mit ziemlich kurzer, nach vorne gerichteter, weisslichgelber Behaarung. Schildchen dreieckig, vertieft.

Flügeldecken fast doppelt so lang als zusammen breit, hinter der Schulter mässig eingedrückt, nach der Mitte am breitesten, im letzten Drittel gemeinschaftlich abgerundet, fein und dicht punktiert, dazwischen sehr fein punktuert. Die Scheibe deutlich gestreift. Die weisslichgelbe Behaarung ist nicht so dicht wie am Halsschild, jedoch etwas länger, schräg absteehend nach rückwärts gerichtet.

Unterseite ziemlich gleichmässig braun, fein und dicht punktiert, mit gelben Haaren bedeckt. Die von den Mittelhüften schräg gegen den Seitenrand verlaufende Linie ist vorhanden. Die Schenkellinie des ersten Abdominalsternites vollständig, innen vom Hinterrand des Sternites zur Basis desselben bogenförmig zurückkehrend.

Füsse braun, Tarsen gelb, Vorderschienen angedunkelt, auf der Aussenseite mit sieben Dornen bewaffnet. Länge 4 mm.

Patria: Singapore. Drei Exemplare, hievon zwei im British Museum, London, und eines in meiner Sammlung. Eines derselben war von Grouvelle's Hand als "*Heterocerus micans*" bezeichnet, welchen Namen ich der Art erhalten habe.

Heterocerus (Littorimus) marshalli, sp. n.

In der Form und Gestalt mit *Heterocerus micans* übereinstimmend, jedoch von demselben durch ungesteifte, viel stärker punktierte Flügeldecken verschieden. Die Oberseite ist ohne Erzglanz.

Kopf etwas breiter als lang, fein und dicht gelb behaart, Kiefer- und Lippentaster braun, Fühler dunkelbraun, elfgliedrig mit siebengliedriger Keule. Oberlippe $1\frac{1}{2}$ mal breiter als lang, in der Mitte am breitesten, zur Basis schwach, nach vorne stark verengt.

Halsschild doppelt so breit als lang, so breit wie die Flügeldecken, Vorderecken stumpf, Seiten bogenförmig nach vorne mässig verengt, an der Basis am breitesten, mit fein gerandeten, an der Spitze nur schwach abgerundeten Hinterecken, fein und dicht punktiert, mit kurzen, nach vorne gerichteten gelben Haaren dicht besetzt, die Seiten mit abstehenden langen Haaren untermischt. Schildchen dreieckig, nicht vertieft.

Flügeldecken glänzend, fast doppelt so lang als zusammen breit, parallel, im letzten Drittel gemeinschaftlich abgerundet, deutlich und mässig dicht punktiert, dazwischen fein punktuert. Die Scheibe ohne Spuren von Streifen. Die gelbe Behaarung ist schütter, kurz, schräg absteehend nach rückwärts gerichtet, an den Seiten mit langen Haaren besetzt.

Unterseite mässig dicht, ziemlich stark punktiert, rostbraun, dicht und kurz goldgelb behaart, die Seiten des Prosternums und des Abdomens mit langen Haaren besetzt. Die Schenkellinie des ersten Abdominalsternites vollständig, innen zur Basis desselben bogenförmig zurückkehrend. Die von den Mittelhüften schräg gegen den Seitenrand verlaufende Linie ist vorhanden.

Füsse rostbraun, auf der Aussenseite der Vorderschienen mit sieben kurzen, schwachen Dornen besetzt. Länge 4 mm.

Patria: Bengal (Dacca). Zwei übereinstimmende

Exemplare, hievon je ein Stück im British Museum, London, und im Imperial Bureau of Entomology, London.

Ich widme diese interessante Art Herrn Dr. Guy A. K. Marshall.

Heterocerus (Littorimus) arrowi, sp. n.

Länglich, ca. $2\frac{1}{2}$ mal länger als breit, flach gewölbt, mattglänzend, braunschwarz, ohne Spuren von Makel.

Kopf so breit als lang, fein und dicht behaart, Stirn mässig gewölbt, Oberlippe fast quadratisch, mit abgerundeten Vorderwinkeln. Kiefer- und Lippentaster braun, Fühler von derselben Farbe, elfgliedrig mit siebengliedriger Keule.

Halsschild an der Basis doppelt so breit als lang, so breit wie die Flügeldecken, nach vorn verengt. Vorderwinkel stark abgerundet, mit gut sichtbar gerandeten, an der Spitze nur schmal abgerundeten Hinterecken. Punktierung fein und dicht. Die gelbe Behaarung ist lang und anliegend, nach vorne gerichtet, mässig dicht. Schildchen dreieckig, doppelt so lang als breit, nicht vertieft.

Flügeldecken fast doppelt so lang als zusammen breit, parallel, hinter der Schulter mässig eingedrückt, nach der Mitte gemeinschaftlich abgerundet, weitläufig und stark punktiert, zwischen der Punktierung fein punktuert. Die gelbe Behaarung ist schütter, ziemlich lang, schräg abstehend nach rückwärts gerichtet. Die schwarzbraunen Flügeldecken sind an ihrer Spitze verschwommen rötlich gefärbt, ihre Scheibe ist nicht gestreift.

Unterseite rostbraun, weitläufig punktiert, zur Mitte des Abdomens dichter werdend. Die metasternale Naht und die Schenkellinie wie bei der vorhergehenden Art gebildet.

Füsse rostbraun, die angedunkelten Vorderschienen mit zehn, zur Spitze kräftig werdenden Dornen bewehrt. Länge 4 mm.

Patria: Bengal. Ein Exemplar im British Museum, London. Ich erlaube mir, diese interessante Art Herrn Kustos Gilbert J. Arrow ergebenst zu widmen.

XVIII.—*Notes on the Cephalopoda*.—VI. *On Grimpella, a new Genus of Octopoda, with Remarks on the Classification of the Octopodidæ*. By G. C. ROBSON, M.A.

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AMONG the unnamed examples of Octopoda in the Zoological Department of the British Museum I have recently come across a very remarkable specimen which merits special attention. I have assigned to it a position as the type of a

new genus, and at the same time I take this opportunity of drawing attention to the necessity of regrouping the Octopod genera placed by Grimpe in his subfamily Octopodinæ (1922) in the last comprehensive classification of these forms. Grimpe's classification of the family Octopodidæ is as follows :—

Family OCTOPODIDÆ.

Subfamily ELEDONINÆ.

1. *Eledone*.
2. *Eledonenta*.
3. *Velodona*.
4. *Graneledone*.

Subfamily OCTOPODINÆ.

1. *Octopus*.
2. *Scæurgus*.
3. *Bathypolypus*.
4. *Benthoctopus*.
5. *Atlantoctopus*.
6. *Haptochlæna*.
7. *Macrotritopus*.
8. *Cistopus*.
9. *Pinnoctopus*.
10. *Enteroctopus*.

In the monograph of this group, which I am preparing, the relationship of these genera will be fully discussed. In the meantime, in describing this new genus, it is desirable to point out that it constitutes an addition to the group of Octopodine forms which are deprived of an ink-sac and probably of abyssal habits. I think that this group thus reinforced is in need of recognition as an important category within the Octopodidæ, and I therefore take this opportunity of suggesting that the three genera concerned should be taken out of the Octopodinæ and placed in a separate subfamily, to which I give the name Bathypolypodinæ. The arrangement of this group would be as follows :—

Family OCTOPODIDÆ.

Subfamily 1. ELEDONINÆ (as before).

Subfamily 2. OCTOPODINÆ (as before, without nos. 3-4).

Subfamily 3. BATHYPOLYPODINÆ.

Bathypolypus.

Benthoctopus.

Grimpella, gen. nov.

The new subfamily would be briefly defined as follows :—
Octopods mainly abyssal in habitat and devoid of an ink-sac. The genus now described for the first time is represented by a single male specimen from Port Lincoln, S. Australia. It

was obtained about 1860 from the Zoological Society of London, but there are no other particulars available. It is quite uncertain from what depth it was obtained; so that it cannot be accepted as an abyssal form. Nevertheless, it has so many points of resemblance with the deep-water Octopodinae that we have no doubts as to its position.

The outstanding feature in the animal's structure is the unique hectocotylus. This is unlike any other I have examined, its remarkable feature being the fact that the calamus is thicker than and almost as long as the ligula (figs. 1, 2). This kind of hectocotylus is quite unknown in this group, the only approach to it being offered by *Octopus tenebricus*, E. A. Smith (Smith, 1884, pl. iv. fig. B, 3), in which the calamus, though small, is prominent and outstanding.

GRIMPELLA, gen. nov.

Octopods, the hectocotylus of which is provided with a calamus nearly as long as and deeper than the ligula. The radula has degenerate adlaterals. The funnel-organ is in two parts (see fig. 3), as in *Bathypolypus*. The arms are long and the web deep. There is no ink-sac.

Type of the genus: *C. thaumastocheir*, Robson, 1928, in the Zoological Department, British Museum (*v. infra*).

Grimpella thaumastocheir, sp. n.

One specimen (♂) from Port Lincoln, S. Australia (1928.4.3.1).

Dimensions (in mm.).

Mantle, length (dorsal)	25
width	25
interocular width	22
Arms: L. 1	110
2	117
3	117
4	117
R. 1	—
2	—
3	57
4	—
Web: section 1-1	33
1-2	31
2-3	30
3-4	31
4-4	28
Suckers (largest)	5.5

Fig. 1.

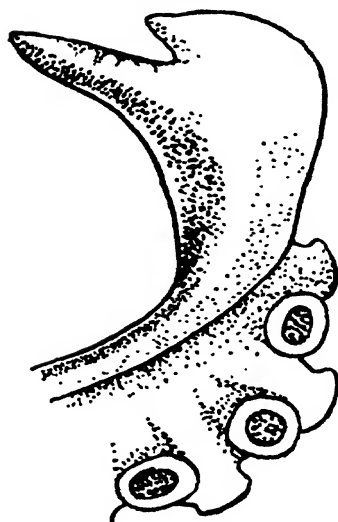
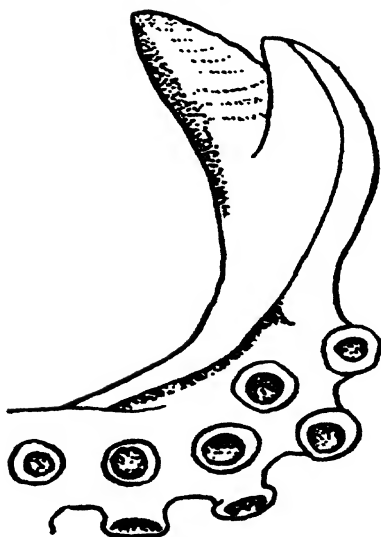


Fig. 2.



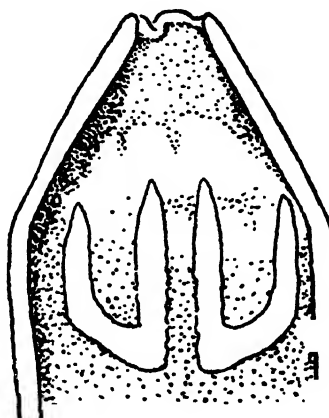
Grimpella thaumastocheir, sp. n.

Fig. 1.—Hectocotylus (side). $\times 8$.

Fig. 2.—Hectocotylus. $\times 8$.

The mantle is small, flattish, and as wide as it is long, the head being only slightly narrower. There is no nuchal constriction, the general appearance being very like that of *Bathypolypus arcticus* or *B. grimpei*. This similarity is heightened by the surface-sculpture, which is composed of fairly numerous warts which are more numerous around the eyes. The body is soft and gelatinous and of a uniform dull purple colour. The arms are subequal and long (81 per cent. of the total length). The sections of the web are also subequal and rather ample (30 per cent. of the arms in length). The suckers attain a maximum diameter of 22 per cent. of the

Fig. 3.

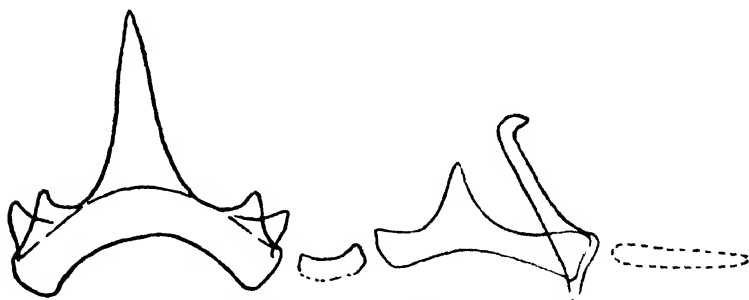
*Grimpella thaumastocheir*. Funnel-organ. $\times 4$.

mantle-length at about the 9th pair. The oral surface is completely flat, the arms rising from it at right angles. This condition, if natural, is most extraordinary. It has the appearance of being produced artificially—*e. g.*, by the arms having been tied at their bases round a circular block, which was pushed down close to the mouth. The early collectors often took special care of Octopods—*e. g.*, by inserting wooden tubes in the funnel, wiring the arms, etc. It is just possible that the peculiar conformation of the oral region is due to this cause. I do not, however, think that it was produced thus for two reasons: (*a*) there is no trace of the marks of a ligature on the bases of the arms, and (*b*) the specimen being in a very relaxed condition, I doubt if the arms would have retained after death the posture thus induced. I do not, however,

feel justified in regarding this condition as natural without future evidence. If it is natural it certainly is without parallel in the order.

The funnel-organ (fig. 3) is in two parts, and the inner arms are more or less vertical. The funnel itself is moderately prominent ($\frac{2}{3}$ of its length are free) and remarkably slender. The locking-apparatus is feeble and not continuous from side to side. The *gills* have seven filaments aside, the number usually found in *Bathypolypus*. There is no trace of an ink-sac. The *mandibles* are rather delicate, the upper pair being imperfectly chitinated. The *radula*: The rhachidian tooth has one or two ectocones on each side, the arrangement of these being more or less symmetrical. It is impossible to state if there is any serial repetition, as the radula was not obtained in a perfect condition. The

Fig. 4.

*Grimpella thaumastocheir*. Radula.

adlaterals are very feeble and the ectocone is very imperfectly developed. The second laterals have a prominent heel; their basal plate is very weak at the marginal end (cf. *Bathypolypus*). The third laterals have a long base, the shaft is straight and slender, and the point is curved backwards to a remarkable degree. The marginal plates are very degenerate. All the teeth with the exception of the rhachidian are delicate, undersized, and weak-looking. I would hesitate before stating that the radula is degenerate; but it is not nearly as well developed as is usual in the order.

The *penis* has a large appendix and a relatively small distal end. The spermatophores are rather larger than usual, and have the general appearance of those of *Bathypolypus*, though they do not attain the great size found in that genus. The *hectocotylus* is about 10 per cent. of the third arm in length. The calamus is thick, heavy, and long,

being three-quarters of the total length of the organ. The ligula is simple, flat, and transversely marked by faint ridges.

Affinities. This very interesting form is undoubtedly related more closely to *Bathypolypus* than to *Benthoctopus*. The general build, sculpture, funnel-organ, and depth of the web are all reminiscent of that genus. The length of the arms and the characters of the rhachidian tooth of the radula are more like those of *Benthoctopus*. The rest of the features of the radula and the hectocotylus easily separate this form from all the known representatives of those genera.

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XIX.—*Morphology and Evolution of certain Jurassic Terebratulids.* By M. R. SAHNI, M.A. (Cantab.), D.I.C., Ph.D. (London), F.G.S.

(Being part of Thesis approved for the Degree of Doctor of Science in the University of London.)

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I. INTRODUCTION.

An investigation of the internal structures of Upper Cretaceous Brachiopoda with the aim of separating them into distinct stocks has suggested a similar study of the Jurassic Terebratulids. Mr. S. S. Buckman has already carried out

a detailed study of the Jurassic Terebratulids, and separated these into over twenty genera. His conclusions are based on the morphogeny and differences in the shape of the muscle-impressions of these forms. He has drawn attention to the fact that similar characters have over and again developed in different stocks producing Homœomorphous forms. Similar types of plication, for example, have appeared in forms which are not related to each other, and this has led to heterogeneous grouping, so that the taxonomic divisions cut across the true phyletic series. To cite an instance: "If the anterior margin of *Eudesia* be compared with that of *T. fimbria* both appear to be the same—multiplicate rectimarginate. Then the fully plicate *Eudesia* might be supposed to represent simply a further development of the semi-plicate *T. fimbria*. But their developmental history is quite distinct. *T. fimbria* shows the direct multiplication of the rectimargin. *Eudesia* has passed through the everted (lopothyrid) stage, and attained to multiplication by a long process of repeated splitting (sulcation) of phcæ, which has reduced the eversion till a rectimargin has been again acquired." (Buckman, 1917*.)

The study of the internal structures, such as the brachidia, of Terebratulids has proved to be a factor of great importance in determining the true genetic position of different forms. This method not only seems to differentiate between Homœomorphous species, but it is also reliable in dealing with forms which might have been separated on the basis of characters which are undergoing rapid evolution. Reference to this will be made in the following pages, particularly under the consideration of the affinities of the genera *Lobothyris*, Buckman, and *Plectoudothyris*, Buckman.

II. LITERATURE.

The history of the systematic study of Brachiopoda is one sustained effort to divide and subdivide the genus *Terebratula*†. Fabio Colonna (1616) described and figured two Terebratulæ and one Rhynchonellid‡. Lhwyd (1698), however, for the first time used the term *Terebratula* for several different Brachiopoda, including such widely different forms as *Terebratula maxillata*, *T. digona*, *T. lagenalis*, etc.§. His genus

* Buckman, S. S. (1917), p. 82.

† For part of the following summary the author is indebted to the work of H. Douvillé, 'Genres de Brachiopodes' (1879).

‡ Colonna, F. (1616), p. 22.

§ Lhwyd, E. (1699), p. 10.

Terebratula was therefore polyphyletic. Furthermore, according to Douvillé, it was Klein (1753) who first established the genus *Terebratula* in taking Lhwyd's termination and applying it to the first two fossils figured by Colonna*. Linnaeus (1758) revived the term used by Fabio Colonna and created the genus *Anomia* for all Brachiopoda living and fossil then known†. Buckman (1907) has shown‡ that the genus *Terebratula* should be ascribed to Müller (1776)§ and not to Klein (1753). Lamarck (1801), and again (1819), united the greater number of Brachiopoda under the genus *Terebratula*, though he distinguished two groups among them: forms with smooth shells and forms with shells longitudinally striated||.

Although Sowerby and others gradually cut off from *Terebratula* such Palæozoic genera as *Spirifer* and *Productus*, it still remained a very wide term when von Buch (1834) put forward his classification¶. The classification adopted by von Buch was, however, more elaborate, but based almost exclusively upon external characters, and was, therefore, not natural. He recognised two main divisions in the Brachiopoda—I. *Plicatæ* and II. *Non-plicatæ*, which were further subdivided. D'Orbigny (1847), and again (1849), established several new genera of Brachiopoda, but without attaching any great importance to their internal structure**. His subdivisions also were based upon external characters, presence or absence of deltidium, area and the form of the cardinal region. King (1850) really laid the foundation of the classification adopted at the present time††. He first recognised the importance of the internal structure, without, however, ignoring other characters, such as the form of the shell. King's work was soon followed by Davidson's (1851, etc.) classical Memoirs on the Jurassic and Cretaceous Brachiopoda‡‡. He created several new genera, and was probably the first palæontologist to attempt a systematic study of the internal structures—brachial skeleton, muscle-impressions, septum, etc.—of Brachiopoda.

However, the methods which were then available were

* Klein, J. Theodore (1753), p. 171, pl. xi. fig. 74.

† Linnaeus, C. (1758), p. 700.

‡ Buckman, S. S. (1907), p. 525.

§ Muller, O. F. (1776), p. 249.

|| Lamarck, J. B. (1801), p. 138.

¶ Buch, L. von. (1834), p. 29.

** D'Orbigny (1847), p. 281.

†† King, W. (1850), 'British Permian Fossils.'

‡‡ Davidson, Thomas (1851, 1852, etc.). Mon. Brit. Fossil Brach. and Supplements (1874).

extremely slow, and could be employed in working out the softest matrix only. To expose the brachial apparatus of a specimen—say, from the hard oolites—would certainly have been out of the question, except where the matrix had undergone natural weathering. But apart from this, Davidson does not appear to have recognised the real importance of the brachidia for generic separation. Deslongchamps (1862) set aside the classification adopted by King*. The families of Brachiopoda established by d'Orbigny and King became the genera *Terebratula*, *Epithyris*, etc.

"An important modern step in the subdivision of *Terebratula* was taken by Douvillé (1880)†. His genera were founded on the obvious modification of shape which had previously attracted attention—*Biplicatae*, *Antiplicatae*, and so on, but the possible diversity of origin of the forms grouped under any one such heading had not been recognised, nor was it expressed in the nomenclature which Douvillé proposed."

"A comprehensive analysis of *Terebratula* was made by Rothpletz (1886). He divided the genus *Terebratula* into 8 groups—*Biplicatae*, *Uniplicatae*, and so forth, and these he parted into some 28 sippe or clans‡. However, his arrangement takes little account of morphogenetic development" (Buckman, 1917, pp. 77–78). Oehlert's (1887) contributions to the classification of Brachiopoda, in Fischer's 'Conchyliologie,' are invaluable§. He attached a great deal of importance to the internal structures, brachial apparatus, hinge-characters, etc., of the genera which he created.

"No systematic account of the Brachiopoda could be complete without taking into consideration the important and exhaustive work of Mr. S. S. Buckman. Apart from his numerous researches, he published (1917) his remarkable 'Memoir on the Brachiopoda of the Namyau Beds, Northern Shan States, Burma,' giving therein for the first time|| a comprehensive morphogenetic study of several Rhyneconellids and Terebratulids. . . . He has shown in a very lucid manner that it is only by a careful study of the Morphogeny of an individual specimen that its true genetic position can be ascertained, or the full significance of its relationship with other forms adequately appreciated. Far more importance was attached to the *method* by which a certain type of

* Deslongchamps (1862), Terrain Jurassique, Pal Française.

† Douvillé, H. (1879), Bull. Soc. Géol. de France, ser. 3, vol. vii.

‡ Rothpletz (1886), pp. 75–81.

§ Fischer, P. (1887), p. 1187.

|| Buckman, S. S. (1917), "Memoir on Burma Brachiopoda."

plication—biplication or multiplication, for example—was attained, rather than the actual *type* of the plication itself. For it has been demonstrated that similarly plicate shells have in several cases reached their adult forms along different developmental lines, and so must be separated.” In this connection we have already referred to *Eudesia* and *T. fimbria*. Apart from an extensive study of the different types of plication, he devoted much attention to beak-characters, and distinguished several morphogenetic stages of development, *Hypothyrid*, *Submesothyrid*, *Mesothyrid*, etc., of beak-ridges with respect to the foramen. Much emphasis was laid also upon the shape of the muscle-impressions, and these were treated as being of generic importance.

During the period from 1923–25 the present writer was engaged in investigating the internal structures of the Terebratulids found in the Chalk*. He was able to show that the brachidia could be utilised for separating different Terebratulid genera, and that the muscle-impressions could not always be relied upon for such separation. These conclusions have received support from further investigations of Upper Cretaceous Terebratulids which have been carried out since 1925.

III. TECHNIQUE.

In an investigation of this kind technique holds an important place. A good deal of experimental work had to be carried out in order to develop the internal structures of Jurassic species, for different methods had to be employed from those utilised for the investigation of Chalk Terebratulids (Sahni, 1925, p. 354). Owing to the hardness of the Jurassic matrix, it was found to be no easy task to remove the anterior portion of the valves without materially damaging the shell. Moreover, the difficulty of drilling with an ordinary burr along the line of junction of the two valves, till they could be split apart, was practically insurmountable, the heterogeneity of the matrix considerably adding to it.

In developing the internal structures of Jurassic Terebratulids the following procedure is adopted. The specimen is cut across obliquely (fig. 1) by means of an ordinary rock-cutting machine, leaving a small portion of the beak so that its principal characters are still recognisable, while, at the same time, the entire dorsal valve, and the greater part of the ventral valve is preserved. The beak is then removed and the brachial skeleton exposed by means of a cross-cut burr, preferably commencing the process of drilling near the cardinal process or the crural bases.

* Sahni, M. R. (1925), pp. 353–385; (1925) A, pp. 497–502.

When a large number of specimens is available the brachial or pedicle or both valves may be ground down on a water-of-ayr stone, and this procedure is particularly advisable in the case of the smaller specimens. Each specimen should be treated on its merits, but experience alone will tell which method is preferable for any particular specimen. Thus, for example, the brachidium in the genus *Plectidothyris* rises

Fig. 1.

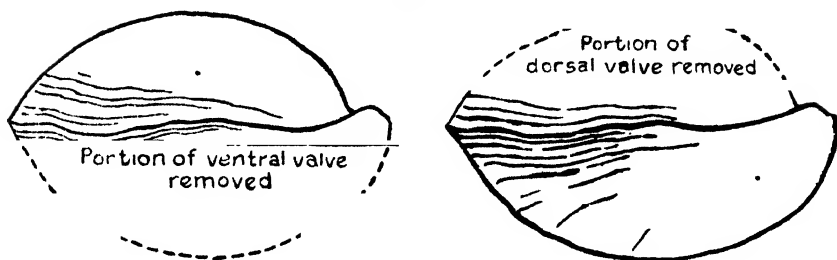


Fig. 2.

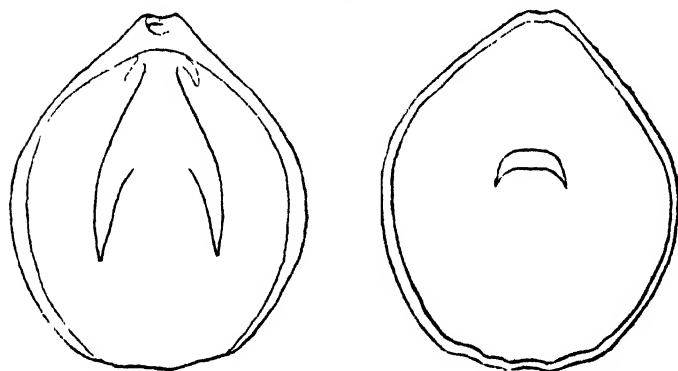


Fig. 1.—Specimens cut across obliquely before commencing developing operations.

Fig. 2.—Showing the dorsal and ventral valves partly ground down to expose the ventral surface of the loop and transverse band.

considerably above the margin of the dorsal valve, so that in removing the pedicle-valve allowance has to be made for this factor.

In the case of the Chalk Terebratulids a tooth polishing brush was used in removing the matrix, or, alternately, a small burr could be employed for this purpose—especially when exposing the ventral portion of the brachidium. Owing

to the hardness of the Jurassic matrix, the use of a tooth polishing brush is out of the question, so the ventral surface of the brachidia is exposed by grinding down the dorsal valve till the former is just visible (fig. 2).

The rest of the loop may then be developed along this line of exposure. Unfortunately, small success was met with in obtaining the dorsal muscle-impressions, but this has been achieved by Mr. Buckman's burning process*. The Chalk Terebratulids, it should be observed, proved more amenable and yielded muscle-impressions showing details with great accuracy and distinctness. Nor was it possible to obtain the impressions of either the dorsal or ventral pallial sinuses—as was the case with specimens from the Chalk. There can be no doubt, however, that these will be revealed by the use of better and finer methods.

Mention must be made of the fact that an attempt was made to take X-ray photographs of the internal structures of the Jurassic Brachiopods, and the following different types of matrices and conditions of preservation of the shell were utilised for this purpose:—

- (a) Silicified natural casts of Terebratulæ from the Chalk.
- (b) Calcified specimens (of *Dielasma hastata*) from the Carboniferous Limestone.
- (c) Internal casts of Terebratulids with a hard chalk matrix.
- (d) Specimens with internal Chalk matrix.
- (e) Other Terebratulids with clay and oolitic internal matrix (Jurassic).
- (f) Specimens of *Waldheimia digona* (Bradford Clay) kindly lent to me by Professor A. Morley Davies.

The results were far from satisfactory, for, with the exception of one solitary specimen of *W. digona*, nothing could be made of the brachidia, and even in this case the outline was far from clear.

IV. THE GENERA *LOBOTHYRIS*, BUCKMAN, AND *PLECTOIDOTHYRIS*, BUCKMAN.

The principal reason which led to an investigation of the internal structures of Jurassic Brachiopoda was the desire to ascertain how far a correlation could be established between their muscle-impressions and brachidia, particularly in view of the conclusions I had already arrived at from a comparative study of the different internal structures of Chalk

* Buckman, S. S. (1911), p. 163; (1912), p. 593; (1912), p. 133.

Terebratulids. In an earlier paper on the Zonal and Morphological study of Chalk Terebratulidæ I ventured to make the following observation: "In spite of the fact that almost perfect gutta-percha casts of the muscle-impressions etc. were obtained, showing in many cases details with great clearness, I was unable to establish any definite correlation between the shape of the loop and that of the muscle-impressions or pallial sinuses. The conclusion then seems inevitable that were it possible to work out their brachial skeletons the position of some at least of the Jurassic Terebratulids, which have been separated on the basis of their muscle-impressions, may have to be interchanged: for there is no reason to suppose that a basis of classification which has been found to be a true and natural one for the Chalk Terebratulids should break down when applied to other Terebratulids, whatever their geological age." (Sahni, 1925, p. 359.)

This conclusion has been confirmed by a study of the internal structures of the genera *Lobothyris*, Buckman, and *Plectoidothyris*, Buckman. Of the genus *Plectoidothyris* the species *P. polyplecta* and *P. plicata* have been investigated, and in a recent work M. Dubar (1925) has figured several brachidia of forms like *Lobothyris punctata* (Sow.), *L. subpunctata* (Sow.), and *L. davidsoni* (Haime), etc.*. However, before M. Dubar's work came to my notice, I had already developed the internal structures of *Plectoidothyris polyplecta*, *P. plicata*, etc. A comparison of the brachidia of *Plectoidothyris* and *Lobothyris* (fig. 11, p. 134, and fig. 13, p. 135) has shown conclusively that they are identical in every respect, and, moreover, that they are much longer than the usual type of brachidium found in the "short-looped" forms. But more will be said on this point presently. The genera *Plectoidothyris* and *Lobothyris* are therefore synonymous. Further evidence as regards the synonymy of these two genera is obtained from a study of their morphogeny. To facilitate comparison I quote the original description of these genera in full:—

"*LOBOTHYRIS*, S. Buckman.

"Type, *L. punctata*, J. Sowerby, sp. Pl. xx.

"*Definition*.—Ephyrid (beak overhanging dorsal umbo, foramen more or less elliptical, in old forms labiate; symphytium broad); Morphogeny, subconcavo-convex to biconvex, to elongate, to uniplicate, to sulcificate, centro-nella to Terebratula stage. Muscle-tracks, narrow, subapproximate."

* Dubar, G. (1925), pls. vi. & vii.

The following species among others are included within this genus :—

- Terebratula punctata*, J. Sow.
 „ *subpunctata*, Davidson.
 „ *edwardsi*, Davidson.
 „ *crickleyensis*, S. Buckman.

The description continues : “ It is possible that all the species (referring to the complete list) here brought together do not belong to one genetic series, but are successful off-shoots from a plano-convex or perhaps circular biconvex stock. If so, the present classification will have fallen into the error it was desired to avoid. But though this may be suspected there is at present no satisfactory method of proof and separation.” (Buckman, 1917, pp. 107–109.)

According to the evidence which has accumulated as a result of the study of the internal structures of Brachiopoda during the last five years, the brachial apparatus provides a very “satisfactory method of proof and separation” of the different stocks.

Under the genus *Plectoidothyris* the following description appears :—

“ PLECTOIDOTHYRIS, S. Buckman.

“ Type *P. polyplecta*, S. Buckman, sp. Pl. xx. p. 14.

“ *Definition*.—Permesothyrid (young), epithyrid (adult), (beak short, obliquely truncate, incurved only in old age, foramen somewhat large, almost apical, attrite, symphytium broad, very short); Morphogeny concavo-convex to elongately biconvex to fimbriate (multiplicate), muscle-tracks long, sub-approximate, sub-divergent.”

Species included here are :—

- Terebratula polyplecta*, S. Buckman.
 „ *plicata*, J. Buckman.

“ The later species *P. polyplecta* is in certain respects less advanced than the earlier form *P. plicata* ; it shows the sulcate stage quite distinctly, whereas in *P. plicata* this is feeble and occasional. The beak of *P. polyplecta*, too, is generally shorter and more obliquely truncate, and so the foramen occupies a more apical position, but in degree of plication the latter species is much more advanced.

“ Before plication this genus seems to go through much the same series of change as *Lobothyris* ; but that it is merely a plicate development of *Lobothyris* seems to be negatived by the shortness of the beak, which does not at all fit in with the beak of that genus.” (Buckman, 1917, pp. 122–123.)

It will be observed from the foregoing description that the genera *Plectoidothyris* and *Lobothyris* possess a similar morphogenetic history and such differences as there exist between them are differences of degree rather than of kind and may be found within different species of the same genus. *This coincidence of a similar morphogenetic history with identical types of brachidia provides strong evidence of the identity of these two genera.* Judging from the figures the difference between the dorsal muscle-marks does not appear to be great, a corresponding difference having been noted in the dorsal muscle-impression of congeneric species of Chalk Terebratulids. Certain species of *Lobothyris* like *L. punctata*, *L. subpunctata*, should, therefore, be transferred to *Plectoidothyris*. For those species included under *Lobothyris* which may subsequently be shown to possess a type of brachial apparatus different from that of *Plectoidothyris* a new genus will have to be created. This is precisely what I had ventured to anticipate in the work on Chalk Terebratulids (Sahni, 1925, p. 359). The subdivision of the Jurassic genera of Terebratulids has probably gone too far, but in the absence of our knowledge of all of their internal characters this was not altogether avoidable.

V. EVOLUTION OF THE BRACHIAL APPARATUS IN TEREBRATULIDS.

It has been customary to credit the Terebratulidæ with short loops—i. e., loops attaining a length of about one-third that of the dorsal valve,—and this constitutes, together with the more pronounced dorsal median septum and differences in the shape and length of the brachial apparatus of the long-looped forms, an important distinction from the latter. All the Chalk Terebratulid genera which the author worked out possessed typical short loops of the usual type. During the course of the work on Jurassic Brachiopoda, however, an entirely unexpected state of affairs was noticed, for in one genus at least—namely, *Plectoidothyris*, Buckman—the brachial apparatus was found to attain a length equal to that of the brachidia in the Terebratellidæ, the true long-looped forms. Slightly longer loops than those of the Chalk Terebratulids were, indeed, noticed by Deslongchamps in *Epithyris maxillata*, Phillips (= *E. bathonica*, Buckman), and this along with the supposed presence of a dorsal median septum led him to remark: “La présence d’un septum médian dans l’antérieur de la grande (petite) valve est un des caractères principaux qui

distinguent le sous-genre *Waldheimia*. Ce rudiment de septum médian, coïncidant avec un appareil brachial, plus étendu qu'il n'est habituellement dans les terebratulés proprement dites, indique une tendance vers le premier de ces groupes" (1862). According to Buckman "the characters of distinction noted above and the more developed brachial apparatus mentioned by Deslongchamps . . . place *Epithyris* in a position intermediate between the *Dallinines* and other genera of plicate Terebratulidæ. Further, the permesothyrid beak with well developed beak-ridges and telate foramen is a combination of characters much more Dalliniiform than Terebratuliform." The description continues: "The nature of the brachial apparatus is given on Deslongchamps' authority and I have not been able to confirm it" *.

The present writer has worked out the internal structures (brachial apparatus etc.) of several specimens of *Epithyris bathonica*, Buckman, and finds that the genus possesses a brachial apparatus much larger than is usually met with in the short-looped forms, but there is no dorsal septum to which Deslongchamps refers. But the shape of the loop differs materially from that of the usual short-looped forms and is much more advanced than is met with in the latter, though it does not represent the highest stage of development attained by the loop among the Terebratulidæ. Other genera of Jurassic Terebratulids which I have worked out and which possess larger brachial skeletons are *Pseudoglossothyris*, *Plectothyris*, and *Lobothyris*. The genus *Ptyctothyris*, however, possesses a short loop, and therefore resembles the Cretaceous Terebratulids in this respect.

The larger dimensions of the brachial apparatus in the majority of Jurassic forms and its greater differentiation as compared with that of the Cretaceous Terebratulids suggests an important question as to which of the two are the more advanced.

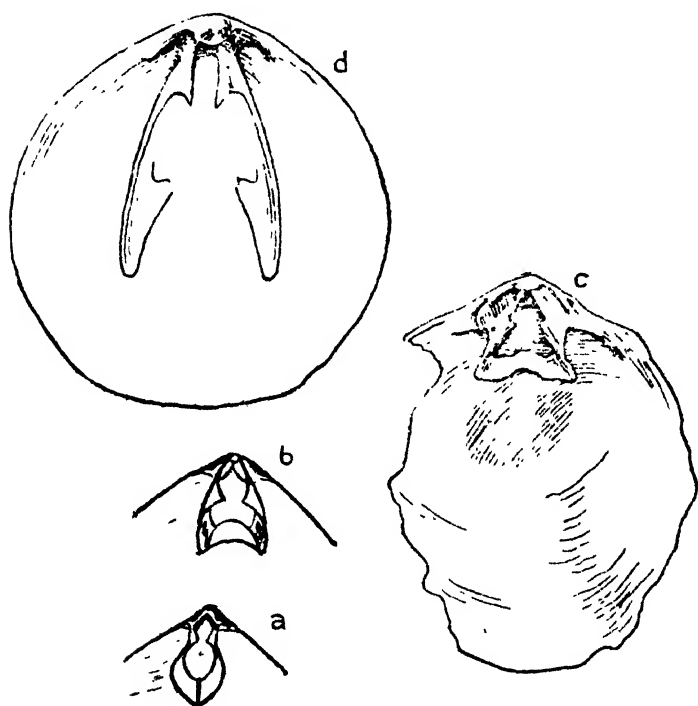
According to the usually accepted hypothesis, the brachidia of the Cretaceous Terebratulids are the more advanced and are derived from those of the Jurassic species. This view is based largely on stratigraphical data. It appears to have been assumed that evolution among the Terebratulids has been a continuous process—that a stock once started continued to evolve through Jurassic and Cretaceous times. But the evidence which has now accumulated as a result of the study of Jurassic Terebratulids, and particularly because

* Buckman, S. S. (1917), p. 119.

of the discovery of the Plectoidothyrid type of loop calls for a modification of this view.

Beecher has shown that the simplest type of loop represented among the Terebratulids is the *Centronella*-loop (fig. 3 *a*), which consists of two crura anteriorly joined together in the median plane. The type of loop represented by *Dielasma* (fig. 3 *b*) passes through the *Centronella*-stage,

Fig. 3.



Stages of loop-development in Terebratulids.

a, *Centronellid*; *b*, *Dielasmid*; *c*, *Neolothyrina obesa*, Sahni (U. Chalk); *d*, *Plectoidothyrid*.

and in the adult resembles in its general character the short loop of the Chalk Terebratulids (fig. 3 *c*). In *Plectoidothyris* (fig. 3 *d* and fig. 11, p. 134), on the other hand, there are long descending branches and shorter ascending branches from which a transverse band is marked off by a distinct constriction on either side. In this character the brachial apparatus

resembles that of the true long-looped forms. The earlier stages of *Terebratula punctata*, Sow., and *Terebratula davidsoni*, Haime (fig. 4), forms which we have shown to fall under *Plectidothyris*, do not possess this transverse band, and in this respect approach the Chalk Terebratulid loops. The conclusion, then, is that the Jurassic Plectidothyrid brachial apparatus passes, during the course of its development, through a stage resembling the Cretaceous type of loop, and that, therefore, the former is more advanced than the latter. Furthermore, several specimens of quite early stages of Cretaceous species were worked out, and did not show greater dimensions (proportionately to the length of the dorsal valve) than the adults. Were the majority of the Cretaceous species the descendants of Jurassic stocks, this ought to be the case. The genera *Centronella*, *Dielasma*, the shorter-looped Jurassic and Cretaceous genera of Terebratulids, and, finally, *Plectidothyris* represent different successive stages of evolution

Fig 4.



Showing young stage of *Terebratula davidsoni*, Haime. (After Dubar.)

and development among the Terebratulidæ. The shorter-looped Terebratulids are more advanced than *Dielasma*, for they do not pass through the *Centronella*-stage of loop-development during their ontogeny, as does *Dielasma*. *Plectidothyris* marks the acme of development and loop-differentiation in the Terebratulidæ.

The study of the internal structures alone is not responsible for the conclusions we have arrived at, for these are supported also by a comparative morphogenetic study of the Jurassic and Cretaceous genera of Terebratulids. The majority of Chalk Terebratulids are comparatively simple forms, being rectimarginate (*Carneithyris*, Sahni, *Magnithyris*, Sahni, *Chatwinothyris*, Sahni), uniplicate (*Concinthyris*, nov., *Ornatothyris*, nov.), or biplicate (*Gibbithyris*, Sahni, etc.). They give no indication of having passed through a long morphogenetic history as do the majority of the Jurassic genera. This association of a long morphogenetic history with larger and more differentiated brachidia

(Jurassic type), and of a simple life-cycle with smaller loops, like those of the Chalk Terebratulids, indicates that the latter are less advanced than the majority of Jurassic forms. The Chalk Terebratulids therefore represent a new stock which is still in its first cycle of evolution. This view I had partly forestalled from a study of beak-characters alone, before the work on Jurassic Brachiopoda was undertaken. In an earlier paper I made the observation: "It is interesting to note that the beaks of Upper Chalk Terebratulids . . . are predominantly mesothyrid or permesothyrid, and this fact is not without significance, for that type of beak is less advanced than the Epithyrid condition which obtains among the large majority of Jurassic species. *The Chalk species may therefore be regarded as developments from stocks more primitive than most of the Jurassic species.*" (Sahni, 1925, pp. 381-82.)

Although Deslongchamps and others have recognised the larger brachidia of Jurassic forms as evidence of relationship with the true long-looped forms, *the two must be regarded as being quite distinct developments.* In this connection, it is worth noting that as a rule the Jurassic Terebratulids show no trace of a dorsal septum (as one would expect to find, were the above view tenable), which is a nearly constant feature of the Terebratellidæ. But apart from this the modes of development of the brachial apparatus in the Terebratulidæ and Terebratellidæ are distinct. The apparent similarity in form is due to parallel development.

VI. CORRELATION BETWEEN THE BRACHIAL APPARATUS AND DORSAL SEPTUM AMONG BRACHIOPODA.

The discovery of considerably longer loops than were hitherto supposed to exist among the Terebratulidæ, and of a fairly well-developed dorsal median septum, in at least one short-looped Chalk Terebratulid has led the present writer to make a detailed correlation between the brachidia and dorsal septa among Brachiopoda. He has been able to demonstrate that although the generally accepted correlation of long loops with a well-developed median septum, and of short-looped forms with a feeble septum or none, is, broadly speaking, recognisable, yet it is not universally so; and that both among the Terebratulidæ and Terebratellidæ there are important exceptions. Similar exceptions, it will be noticed, were found in the case of the generally accepted principle that the Terebratulidæ possessed short loops when the

brachidia of *Plectoidothyris* and *Lobothyris* were exposed. Indeed, it may be doubted whether any such broad correlation between certain of the characters of any group of the animal kingdom would be found to hold universally. In certain Dallinines—*Macendrevia cranium*, for example—a septum is present in the very young condition, but no trace of this structure exists in the adults of this species.

Professor Morley Davies has expressed his ideas on the early evolution of the loop-bearing Brachiopoda in an unpublished paper, from which he allows me to quote as follows:—

“The Devonian (and late Silurian) period may be described as a time of experiment in Brachiopod loops—that is to say, a time when many more diverging stocks than usual were able to survive, because the great new advantage which they shared (the calcified loop) completely overshadowed, for the time, the relative advantage which some of them had over others. (The analogy to the early days of human invention, such as the bicycle, seems quite sound.) Eventually a small number of stocks established their definite superiority over the rest (standardisation of a few types). Something of the kind must always happen when a definite advance has been made, but the less important the advance the sooner is standardisation attained: only in rare cases does the ‘experimental’ stage last through a whole geological period.

“The apparently existing correlation between a long loop and a well-developed septum, and a short loop and a feeble septum or none, was not yet established in the Devonian period.”

It was not till the Jurassic period and its conditions arrived that the long-looped forms attained their pre-eminent position, and the correlation, so far as it went, between long loops and well-developed septa was finally established. But side by side with this (apart from the prolific variety of combination between loop types and septa of the Siluro-Devonian Brachiopoda) were established among the Terebratulidæ many other combinations which broke down the widely accepted generalisation referred to above. Thus the Triassic genus *Cænothyris*, a short-looped form, possesses a well-developed dorsal median septum, and recently, as previously referred to, the writer has come across an instance of a typical short-looped Chalk Terebratulid in which the dorsal septum is stronger than in the adult shell of the true long-looped Dallinine, *Macendrevia cranium*. According to M. Dubar (1925), the Liassic form *Terebratula davidsoni*,

which has a long loop, possesses a remarkably well-developed septum*. It is not suggested, however, that these forms stand in close or direct relationship to one another, but that, on the contrary, *they are parallel developments of different stocks*. The independence of the Chalk Terebratulid stock from the earlier Jurassic forms has already been demonstrated. It therefore appears that a certain amount of repetition in development has taken place in Brachiopoda, resulting in similar yet genetically different forms at different intervals. A similar parallelism may be noted between species of the long-looped Terebratulid genus *Plectoidothyris* and the true long-looped form *Macendrevia carnium*, both of which show practically no trace of a median septum in the adult condition.

Including the forms studied by Professor Morley Davies, the following combinations between the type of brachial apparatus and septum or septa may be noticed:—

(i.) *Stringocephalus*, with long loop of special type and septum, not supporting the loop.

(ii.) *Megalanteris* and *Cryptonella*, with long loop and no septum.

(iii.) *Tropidoleptus*, with medium length loop and supporting septum.

(iv.) *Centronella* and its allies and *Dielasma* and its allies have a short loop without a septum.

(v.) *Centronella* ? *Guerangeri*, de Verneuil, with a Centronellid loop and well-developed septum.

(vi.) *Renesseleria*, with a greatly elongated Centronellid loop and no septum.

(vii.) *Cænothyris*, with short loop of *Terebratula*-type and well-developed supporting septum.

(viii.) *Plectoidothyris*, with a long loop of *Terebratula*-type and no septum.

(ix.) Certain short-looped forms, with well-developed septum, from the Upper Chalk—not related to *Cænothyris*.

(x.) Long-looped forms like *Magellania*, with well-developed septum.

(xi.) Long-looped forms like *Macendrevia*, without a dorsal septum in the adult.

(xii.) Short-looped forms, with a thick pseudoseptum and feeble septum, like *Carneithyris*, *Chatwinothyris*, and the great majority of Chalk Terebratulidæ.

* Dubar, G. (1935), pl. vii. fig. 19.

(xiii.) *Terebratula davidsoni*, var. *crassa*, with a long loop of "*Terebratula*" type and an elongated dorsal median septum.

It will be noticed from the above list that practically every possible combination between the different loop-types and degree of development of the septa exists within the superfamily Terebratulacea. Thus the Terebratulids with short loops may possess practically no septum at all, or only a rudimentary septum, or they may possess a dorsal median septum almost as well developed as is present among some of the true long-looped genera. Similar remarks apply to the longer-looped forms among the Terebratulidæ, though in their case the maximum development of the septum so far known is not as much as in the shorter-looped ones, which is somewhat remarkable.

VII. DESCRIPTIONS OF THE BRACHIDIA ETC. OF CERTAIN BRACHIOPODA, AND OBSERVATIONS ON THE FUNCTION OF THE CARDINAL PROCESS AND PPLICATION.

(i.) *Observations on the Cardinal Process, Plication, etc.*

For a complete description of the genera investigated—that is, their morphogeny, details of muscle-marks, beak-characters, and comparison with other Jurassic Terebratulidæ,—reference should be made to Mr. Buckman's Burma Memoir. In describing their brachidia, the present writer has used the same terminology which he employed in the case of the Chalk Terebratulids*. As I have already remarked, only in rare cases was it possible to expose the dorsal muscle-tracks satisfactorily, but these are beautifully figured in the Memoir referred to above.

In all the genera studied the pseudoseptum is absent, and the septum is represented in most cases by a narrow linear projection, of the type commonly found superposed upon the pseudoseptum of the Chalk Terebratulid genera. The ventral muscle-impressions and the impressions of the pallial sinuses are not observable in the internal casts of Jurassic species of Terebratulids. These, it may be noted, were clearly seen on the artificial gutta-percha casts of the

* The terms referring to cardinalia are employed in the sense in which Thomson uses these for the corresponding structures of Tertiary Brachiopoda.

interiors of the dorsal and pedicle valves of Chalk Terebratulids. Their absence, even on perfectly preserved casts of Jurassic species, is, therefore, rather baffling.

There appears also, at the present moment, no satisfactory explanation for certain filamentous structures present in the matrix of the shell, and occasionally somewhat symmetrically disposed on either side of the median vertical plane. Such structures have been observed in the genera *Epithyris*, *Plectoidothyris*, and *Plectothyris*. In one specimen of *Plectoidothyris polyplecta* acicular filaments were observed arising laterally from the crura, and from the portion corresponding to the descending branches. It is possible that they are in organic union with the brachial apparatus, in which case they may correspond to similar structures observed in certain recent and fossil long-looped forms (1913)*, but this determination is not quite satisfactory.

There are one or two important points which call for modification of the view I expressed in the earlier work on Chalk Terebratulids. While making certain observations on the value of the cardinal process, I remarked that "this feature has unexpectedly proved to be of great importance in the study of Chalk Terebratulids, and in combination with the brachial apparatus can be used for generic diagnosis." The importance of the cardinal process and the hinge-characters cannot be denied, but recent work has shown that a plate-like cardinal process is common to many Jurassic Terebratulids, and, indeed, seems characteristic of all the more strongly plicate forms. It should be made clear that this statement is intended to apply to the Terebratulidæ only. Such differences as exist are somewhat minute. This similarity between their cardinal processes is quite remarkable. A probable explanation to account for this lamellar character of the outer hinge-plates and cardinal process in plicate forms will be given later. The genera *Plectothyris*, *Plectoidothyris*, *Lobothyris*, *Epithyris*, *Ptyctothyris*, and *Pseudoglossothyris* possess lamellar outer hinge-plates, but there are some differences in detail. Even in the case of the rectimarginate species of genera which also contain plicates, the cardinal process of the former is slightly stouter than that of the latter. And the suggestion is offered that the function of the cardinal process is not exclusively to serve as a place of attachment for the diductor muscles, but also, to a certain extent, to keep the brachial and pedicle

* Zittel, K. von (1918), p. 407, fig. 613.

valves interlocked. In this respect, then, the cardinal process partly usurps the function of the teeth and socket-ridges of the ventral and dorsal valves respectively. It is not, however, the writer's intention to suggest that biphication in certain Terebratulidæ should be primarily connected with this function.

(ii.) *Detailed Description of the Internal Structures of certain Terebratulid Genera.*

Genus PSEUDOGLOSSOTHYRIS, Buckman.

Brachial Apparatus.—Crura triangular, anterior and posterior dorsal margins only slightly curved. Ventral margin nearly straight. Crural processes sharp, somewhat prolonged. Loop gently arched; the region corresponding to the transverse band is fairly distinct.

Cardinal process without cardinal flaps. Outer hinge-plates lamellar, rather flat, and extend to about half the

Fig. 5.

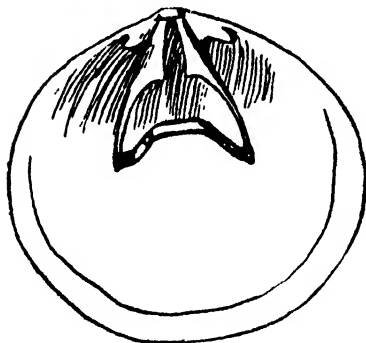


Fig. 6.



Fig. 5.—*Pseudoglossothyris simplex*. Interior of dorsal valve. Nat. size.
Fig. 6.—*Pseudoglossothyris curvifrons*. Dorsal muscle-marks. Nat. size.
(After Buckman.)

length of the crura. Septum absent. In general characters the brachial apparatus appears to resemble that of *Dictyothyris*. "Muscle-tracks long, divergent, often terminally incurving" (fig. 6).

Genus EPITHYRIS, Phillips.

Brachial Apparatus (fig. 7).—Crura triangular; anterior

and posterior dorsal margins fairly well curved. Crural process sharp and prolonged.

There are short ascending branches, and the structure corresponding to the transverse band is fairly distinct. Cardinal process plate-like. Outer hinge-plates lamellar, as in the other genera of Jurassic Terebratulids previously described. "Muscle-tracks long, divergent, curving outwards" (fig. 8).

Fig. 7.

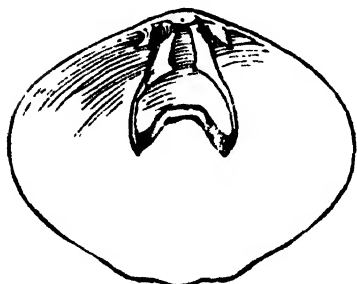


Fig. 8.



Fig. 7.—*Epithyris bathonica* (Buckman) Interior of dorsal valve. Nat size.

Fig. 8.—*Epithyris submaxillata*, Morris-Davidson, sp. Dorsal muscle-impressions. (After Buckman.)

Genus *PTYCTOTHYRIS*, Buckman.

Brachial Apparatus (fig. 9).—Crura triangular; anterior

Fig. 9.



Fig. 10.



Fig. 9.—*Ptyctothyris* (Buckman). Interior of dorsal valve.

Fig. 10.—*Ptyctothyris*. Dorsal muscle-impressions. (After Buckman.)

and posterior dorsal margins only slightly curved; ventral margin straight.

Crural processes sharp, but not prolonged. Loop gently arched and without a transverse band. In this respect it approaches the loops of the Chalk Terebratulid genera. Cardinal process not well developed. Outer hinge-plates lamellar, and adherent to more than half the length of the crura. Septum absent. "Muscle-tracks broad, subspatulate" (fig. 10).

Genus *PLECTOIDOTHYRIS*, Buckman.

Brachial Apparatus (fig. 11).—Crura somewhat triangular. Anterior dorsal margins slightly curved, posterior dorsal margins well curved. Crural processes sharp and much prolonged. They are extremely well shown in some burnt

Fig. 11.



Fig. 12.



Plectoidothyris polyplecta.

Fig. 11.—Interior of dorsal valve.

Fig. 12.—Dorsal muscle-impressions. (After Buckman.)

specimens of *P. plicata*. The crura are prolonged into the descending branches. Anteriorly these widen out into broad triangular plates, whence further extensions constitute the ascending branches, connected by means of a stout transverse band. The outer hinge-plates are comparatively small and curved. Cardinal process more developed than that of *Pseudoglossothyris* or *Ptyctothyris*. Pseudoseptum absent. Septum leaves only a faint linear impression upon the cast, and is even less developed than in many Chalk Terebratulæ. "Muscle-tracks long, subapproximate, subdivergent."

Genus *LOBOTHYRIS*, Buckman.

Brachial Apparatus (fig. 13).—See the description given

Fig. 13.

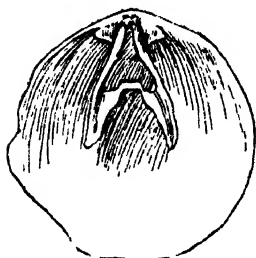


Fig. 14.



Terebratula punctata, Sow.

Fig. 13.—Interior of dorsal valve. (After Dubar.)

Fig. 14.—Dorsal muscle-impressions. (After Buckman.)

under *Plectoidothyris*. “Muscle-tracks narrow, subapproximate” (fig. 14).

Genus *PLECTOTHYRIS*, Buckman.

Brachial Apparatus (fig. 15).—This structure resembles that of the two previous genera, but is somewhat broader

Fig. 15.

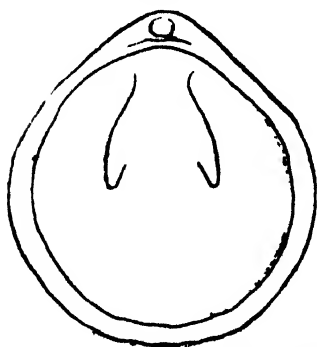


Fig. 16.



Plectothyris fimbria, J. Sowerby, sp.

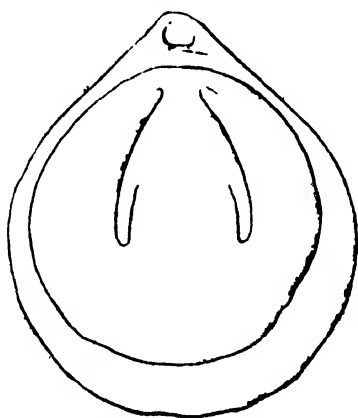
Fig. 15.—Dorsal valve ground down to show the brachidium.

Fig. 16.—Dorsal muscle-marks. (After Buckman.)

and shorter, and in this respect corresponds to the general structure of the shell. It has already been mentioned that the brachial apparatus of *Plectoidothyris* is variable in

length. For this reason a comparison between figs. 11, 15, and 17 is instructive. "Muscle-tracks long, subapproximate, subdivergent" (fig. 16).

Fig. 17.



Plectoiothyris plicata, J. Buckman.

Dorsal valve ground down to show the brachidium.

VIII. SUMMARY.

This brings the study of Jurassic Brachiopoda to a close, so far as this paper is concerned. Although only a fringe of this problem has been touched in the foregoing pages, it has at least served to demonstrate that our knowledge of even some of the more familiar genera of Brachiopoda is far from complete. The study of internal characters has shown that they are not only invaluable for separating homœomorphous species, but that they are certain criteria for establishing the true genetic relationship between stocks which may have been separated on the basis of characters which are undergoing rapid evolution, as in the case of the "genera" *Lobothyris* and *Plectoiothyris*. The minute subdivision of Brachiopod genera (like that of the Ammonoidea) has probably gone too far, and this has resulted in the separation of closely allied species.

The evidence regarding the small value of muscle-impressions for generic diagnosis has already been emphasized in an earlier paper by the writer on Chalk Terebratulids, and the investigation of the Jurassic genera of Terebratulidæ has further served to confirm the conclusions previously

reached. Moreover, the importance of brachidia in separating different Terebratulid genera has been established conclusively.

It has been shown that the usually recognised correlation between a long-looped and a well-developed septum and between a short loop and a feeble septum or none is not universally true.

The assumption that Terebratulids are short-looped forms has been demonstrated to be erroneous, for the brachial apparatus in certain Jurassic forms reaches a length nearly as great as in the long-looped forms, properly so called. The usually recognised division of the Terebratulacea into long-looped and short-looped forms is, therefore, so far as the length alone of the brachial apparatus is concerned, no longer admissible, though the differences between the two types of brachidia should be recognised.

Evidence has been brought forward to show that the brachial apparatus in Terebratulids has evolved in the direction of increase in length, and towards a type represented in *Plectoiothyris*: that this evolution has probably proceeded along such stages as are represented by the loops of *Centronella*, *Diclasma*, the shorter-looped Terebratulids, and *Plectoiothyris*, in the order here given, but no genetic relationship between these genera is implied.

Finally, in all such cases where the morphogenetic history of two genera is similar, the final diagnosis must rest on a knowledge of the brachial apparatus.

In the end, I wish to express my gratitude for the help I have received from various sources. To Professor A. Morley Davies, under whose direction this investigation as well as the previous one on Chalk Terebratulids was carried out, I wish to express my very sincere thanks. I have received much valuable help in discussing several points with him, and he has, moreover, read through the manuscript. I wish, similarly, to acknowledge my indebtedness to Professor W.W. Watts, who has helped me in several ways, and taken so much interest in the work. My thanks are due to Miss M. Wood and Mr. S. S. Buckman for many valuable suggestions. To the Keeper of the Geological Department, Natural History Museum, I am especially indebted for allowing me to make use of the material of Jurassic and Cretaceous Brachiopoda. To the Department of Scientific and Industrial Research my thanks are due for their Research award between the years from 1925 to 1928.

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XX.—*A Study of certain Types of Diplopterous Wasps in the Collection of the British Museum.* By J. BEQUAERT, Ph.D., Department of Tropical Medicine, Harvard University Medical School.

THE entomological collections in the British Museum are unusually rich in diplopterous Hymenoptera, which, largely owing to the efforts of the late G. Meade-Waldo, are in good order. The collection of Hymenoptera is especially valuable, since it includes the types of a large number of species described by H. de Saussure, F. Smith, P. Cameron, R. C. L. Perkins, E. Zavattari, and others—several of these species have not as yet been properly elucidated.

Whenever I have happened to be in London, I have spent some time studying this collection, and in this fashion have accumulated some notes, which I believe may be of value to other students. So extensive is the collection, however, that I have been able to study but a small part of it. Even in this limited material, I confined myself largely to a critical examination of types and of specimens of particular interest for the interpretation of existing descriptions. I wish to express my indebtedness to Dr. J. Waterston, Assistant Keeper, Department of Entomology, for courtesies extended and assistance given on all my visits.

An elaborate nomenclature of so-called "typical specimens" has been introduced by certain entomologists. Most of the terms suggested involve, however, an arbitrary extension of the concept "type," and seemingly were proposed in an effort to include among the coveted "types" as many specimens as possible of each species. In my opinion, there are but three categories of specimens that may rightly claim to represent "typical material" of any species (or lower taxonomic unit) of animals and plants. They are the only ones that I shall recognize in the present paper:—

(1) The *holotype* is the *one* specimen (of either sex) selected by the author as the type, and designated as such with the publication of the original description. Or, if the author neglected to make the selection, it is the specimen selected as such by the first reviser from among the specimens mentioned with the original description. This *one* specimen is the true *type* of the form under consideration, and the one that should exclusively be referred to for any subsequent interpretation of the description. If it is lost or destroyed, it cannot be replaced by any other specimen, not even by one selected by the original describer.

(2) The *allotype* is the specimen selected as the type of the sex opposite to that of the holotype. It is immaterial whether the allotype was described at the same time as the holotype or later, and whether or not by the author of the species (see J. C. Bradley, 'Science,' lxvi. p. 563 (1927)). In case the taxonomic unit exists in several morphological phases of one or both sexes (so-called "castes"), each of the phases distinct from the holotype should have an allotype selected as such.

A species (or lower taxonomic unit) is fully defined by its holotype and allotype (or allotypes, if there are several castes of one or of both sexes), when the sexes are correctly associated. Sometimes, however, the two sexes (or the several castes) have been wrongly correlated, and the allotype is eventually recognized as belonging to a taxonomic unit different from that of the holotype. In this case the holotype alone represents the taxonomic unit under discussion, and carries the name originally proposed for that unit. Categories (1) and (2) are not of the same nomenclatorial value.

(3) The third category comprises the *paratypes*, being all other specimens of either sex (or of any caste) mentioned with the publication of the original description of the holotype as belonging

to the newly proposed taxonomic unit. Although helpful for an interpretation of the original description, in the absence of holotype and allotype, they can never replace them. In case of doubt, a study of the holotype alone can settle the identity of the form under discussion. If the allotype is described subsequently to the holotype, it is not a paratype.

Certain authors persist in the use of the term "cotypes" to include all specimens indiscriminately that were before the describer at the time when he drew up the original description. The use of this term exposes the student to error and should be avoided. It is often used with a vague meaning; some entomologists applying it to specimens merely seen by the describer, even subsequently to the publication of the original description, or distributed by him in exchange, or identified "by comparison with the type." In critical cases all such specimens are practically valueless. For even the original describer may not always recognize his own creation, especially when the holotype is no longer available to him.

In the present paper I confine my remarks almost entirely to the holotypes, allotypes, and paratypes, as defined above. In the collection as arranged at the British Museum, the holotype of each taxonomic unit generally bears a printed label "type," and the selection thus made among the several specimens of each form is, *as a rule*, correct. Some of the other specimens often bear a printed label "cotype." When these specimens were actually mentioned in the original description they are either allotypes or paratypes, and I have accepted them as such. But I have almost wholly neglected so-called "cotypes" received from various sources and which were not used for the drawing up of the original descriptions.

On the whole, the status of the several named specimens in the collection of the British Museum presents no difficulty. An exception must be made for the so-called "types" of the innumerable species described by the late P. Cameron. As is universally known, it is perfectly hopeless to attempt to recognize these species from the descriptions alone, and in many cases even the generic names used are misleading. Much of Cameron's collection eventually reached the British Museum, where it is now available to hymenopterists. In studying the specimens, one should, however, keep in mind three possible causes of error:— (1) Some species recognized and named by Cameron in his collection were never described in print. Their names are *nomina nuda*, without standing in nomenclature. (2) Frequently a species was described in print under a name differing from that used in the collection. (3) When a species was (in Cameron's opinion) represented by several specimens, it was his practice to retain some of them and to dispose of the others, generally by returning them to the owner. In such cases, several quite distinct forms were sometimes confused under one name, and it may become almost impossible to select the true holotype in order to define the species.

Fabricius's types of Diptera, in the Banksian Collection, are not included in the present study. They are fully discussed by the author in a paper to be published in vol. xxiii. of the 'Bulletin of the Brooklyn Entomological Society' (1928). Notes on several of the African species of *Eumenes* are also omitted, since they will be used for a forthcoming paper on that genus.

In order to avoid confusion, I give the reference to the original description in each case. For brevity, Frederick Smith's 'Catalogue of Hymenopterous Insects in the Collection of the British Museum. Part V. Vespidae' is simply quoted as "Smith, 1857."

PARAGIINÆ.

The species of this subfamily having been critically studied by Meade-Waldo (Ann. & Mag. Nat. Hist. (8) v. pp. 31-33 (1910)), I merely list those represented by types. This is the case in 22 of the 24 described species.

1. *PARAGIA DECIPIENS*, Shuckard, Trans. Ent. Soc. London, (1) ii. p. 82, pl. viii. fig. 3 (1837) (female). The holotype (marked "type") is a female without locality. It was obtained in New South Wales.

The male from Adelaide, described by F. Smith in 1865 (Trans. Ent. Soc. London, (3) ii. p. 391), is also in the collection, and should be labelled "allotype" (although it is not yet marked "type").

2. *PARAGIA TRICOLOR*, F. Smith, Trans. Ent. Soc. London, (2) i. p. 41, pl. v. figs. 1 e-k (1850) (female only) = *Paragia saussurii*, F. Smith, p. 2 (1857) (female). The holotype (marked "type") is a female from "W. Australia," which also bears the labels "*Paragia tricolor*, Sm., ♀, Trans. Ent. Soc." and "*Paragia smithii*, Sauss."

3. *PARAGIA SMITHII*, H. de Saussure, Et. Fam. Vesp. iii., Masariens, p. 55, pl. ii. figs. 1 & 1a (1854) (female and male) = *Paragia tricolor*, F. Smith, Trans. Ent. Soc. London, (2) i. p. 41, pl. v. figs. 1 a-d (1850) (male only), and p. 2 (1857) (male). The holotype is a male from Adelaide. The collection contains also a female, which should be regarded as the allotype.

The status of the names *Paragia tricolor*, *P. saussurii*, and *P. smithii* appears to be as follows:—*P. tricolor* was originally based by F. Smith upon the female and the male, but the only locality mentioned in connection with the original description was Perth, W. Australia. The description of the female preceded that of the male. In 1854, H. de Saussure, recognizing that Smith had associated the sexes wrongly, restricted the name *P. tricolor* to the female from Perth. He was quite right in doing so, not only because he was the first reviser, but also because Perth was the type-locality given in the original account. Smith's supposed male of *P. tricolor*, which bore the locality-label "Adelaide," he

described as a distinct species, which he called *Paragia smithii*. In 1857, F. Smith, although recognizing his error, refused to follow H. de Saussure. He restricted the name *P. tricolor* to his male of 1850 (from Adelaide; de Saussure's *P. smithii*). For the female *P. tricolor* of 1850 (from Perth; de Saussure's *P. tricolor*) he introduced the new name *P. saussurii*. But, as his action had been anticipated by H. de Saussure, he no longer had the right to do so. The synonymy here accepted appears therefore fully justified.

4. *PARAGIA VESPIFORMIS*, F. Smith, Trans. Ent. Soc. London, (3) ii. p. 393 (1865) (female). The holotype is a female from Swan River. I have not seen the allotype (male), from Champion Bay, described by F. Smith, Trans. Ent. Soc. London, p. 250 (1868).

5. *PARAGIA ODYNEROIDES*, F. Smith, Trans. Ent. Soc. London, (2) i. p. 42, pl. v. fig. 2 (1850) (described as a male). The holotype is a female from Hunter River.

6. *PARAGIA BIDENS*, H. de Saussure, Et. Fam. Vesp. iii., Masariens, p. 59 (1854) (male). The holotype is a male from Adelaide.

7. *PARAGIA PRÆDATOR*, H. de Saussure, *loc. cit.* (female). The holotype is a female without locality.

8. *PARAGIA CALIDA*, F. Smith, Trans. Ent. Soc. London, (3) ii. p. 392 (1865) (male). This species is represented by the two male specimens mentioned in the original description. One of them, labelled "Champion Bay," agrees exactly with Smith's description of the typical form, and should be regarded as the holotype (although it is now marked "type"). The other specimen, labelled "Adelaide," corresponds to the description of Smith's "var." and should be regarded as a paratype (although it is now marked "type").

9. *PARAGIA VENUSTA*, F. Smith, *loc. cit.* p. 393 (female). The holotype is a female from Swan River.

10. *PARAGIA SOBRINA*, F. Smith, Trans. Ent. Soc. London, p. 309 (1869) (female). The holotype is a female from Swan River.

11. *PARAGIA EXCELLENS*, F. Smith, *loc. cit.* (female and male). The holotype is evidently the female (marked "type"), although it is labelled "Swan River" (and not "Champion Bay," the locality given in the original description). The allotype, also from Swan River, is a male, which is not marked "type," at present in the collection.

12. *PARAGIA MOROSA*, F. Smith, Trans. Ent. Soc. London, p. 251 (1868) (female). The holotype is a female from Champion Bay.

13. *PARAGIA NASUTA*, F. Smith, *loc. cit.* p. 252 (female). The holotype is a female labelled merely "W. Australia," although Champion Bay is given as the locality in the original description.

14. *PARAGIA WALKERI*, G. Meade-Waldo, *Ann. & Mag. Nat. Hist.* (8) v. p. 33 (1910) (male). The holotype is a male from Adelaide River.

15. *PARAGIA DECEPTRIX*, F. Smith, *Trans. Ent. Soc. London*, (3) i. p. 56 (1862) (female). The holotype is a female labelled merely "Australia."

16. *PARAGIA CONCIINNA*, F. Smith, *Trans. Ent. Soc. London*, p. 251 (1868) (female). The holotype is a female from Champion Bay.

17. *PARAGIA MAGDALENA*, R. E. Turner, *Trans. Ent. Soc. London*, p. 89 (1908) (male). The holotype is a male from Mackay, Queensland.

18. *PARAGIA PERKINSI*, G. Meade-Waldo, *Ann. & Mag. Nat. Hist.* (8) viii. p. 750 (1911) (female). The holotype is a female from Cairns, N. Queensland.

19. *PARAGIA HIRSETA*, G. Meade-Waldo, *loc. cit.* p. 749 (male). The holotype is a male from Cairns, N. Queensland.

20. *METAPARAGIA MACULATA* (G. Meade-Waldo) = *Paragia maculata*, G. Meade-Waldo, *Ann. & Mag. Nat. Hist.* (8) v. p. 32 (1910) (female and male). The holotype (the only specimen marked "type") is a female labelled merely "W. Australia." There are several other females and males in the collection, all from the same source. One of the males should be selected as the allotype, some of the remaining specimens being paratypes.

21. *METAPARAGIA PICTIFRONS* (F. Smith) = *Paragia pictifrons*, F. Smith, p. 2, pl. i. fig. 1 (1857) (female). The holotype is a female from Swan River.

22. *METAPARAGIA DODDI*, G. Meade-Waldo, *Ann. & Mag. Nat. Hist.* (8) viii. p. 748 (1911) (female). The holotype is a female from Cairns, N. Queensland.

GAYELLINÆ.

23. *PARAMASARIS FUSCIPENNIS*, P. Cameron, *Trans. American Ent. Soc.* xxvii. p. 312 (1901) (female) = *Zethoides flavolineatus*, P. Cameron, *Trans. American Ent. Soc.* xxx. p. 94 (1904) (male); *Plesiozethus flavolineatus*, P. Cameron, *Entomologist*, xxxviii. p. 269 (1905); *Metazethoides flavolineatus*, W. A. Schulz, *Spolia Hymenopterologica*, p. 213 (1906).

The holotype of *Paramasaris fuscipennis* is a female from New Mexico, which has three submarginal cells in the fore wing. Together with it are placed, in the collection, several specimens from S. Gerónimo, Guatemala (not seen by Cameron). There is

little doubt that the whole series is conspecific with Cameron's type. Yet some of these Guatemalan specimens have three, while others have but two submarginal cells in the fore wing, though no other differences can be discovered among them. I conclude that the number of submarginal cells is a variable feature in this species.

Of *Zethoides flavolineatus* there are in the collection two males from Panama, both labelled "types." They have but two submarginal cells in the fore wing, but agree perfectly with the males of the Guatemalan series mentioned above, some of which, moreover, also have but two submarginal cells. *Z. flavolineatus* I must regard as a synonym of *Paramasaris fuscipennis*. One of the males should be selected as the holotype of *Z. flavolineatus*, thereby becoming the allotype of *P. fuscipennis*. In 1912 (Arch. f. Naturgesch. lxxviii. Abt. A, Heft ii. p. 64), Zavattari described and figured the female of *Z. flavolineatus*, using a specimen from Bogotá, Colombia, that possessed three cells in the fore wing. Not having access to Cameron's types, he did not recognize the identity of *Paramasaris*, Cameron, and *Zethoides*, Cameron. It should still be mentioned that, near the two specimens of *Z. flavolineatus* in the British Museum collection, there is pinned a note in Meade-Waldo's handwriting as follows:—"Agrees perfectly with *Paramasaris fuscipennis* ♂, but only two cubital cells. 26. ii. 1913."

The genus *Zethoides*, Fox (Proc. Ac. Nat. Sci. Philadelphia, p. 436 (1899)), has nothing in common with *Zethoides*, Cameron. *Plesiozethus*, Cameron, and *Metazethoides*, W. A. Schulz, are substitute names proposed for *Zethoides*, Cameron, and all three are exact synonyms of *Paramasaris*, Cameron, since they have the same species as genotype.

Paramasaris was unknown to Bradley when he wrote his valuable 'Taxonomy of the Masarid Wasps' (Univ. of California Publ., Entomology, i. no. 9 (1922)). He suspected, however, that it was identical with *Zethoides*, Cameron (*Plesiozethus*, Cameron), and placed it tentatively in the subfamily Euparagiinæ. It possesses, however, all the characteristics of the subfamily Gayellinæ, and a careful study of the British Museum series convinces me that it is closely allied to *Gayella*. The venation, especially that of the extremely peculiar hind wings, is almost exactly as in *Gayella* (compare Bradley's figure 97 on plate xiii.). In the fore wings, the number of submarginal cells varies, as we have seen; but, when there are three, the second and third each receive a recurrent vein. The fore wings do not appear to be plaited. In the male, the clypeus is quite narrow and the second abdominal tergite bears a pale-coloured median ridge, which is distinctly raised, though broadly rounded off. The antennæ are 12-jointed in the female, 13-jointed in the male, but otherwise of the same shape in both sexes, the flagellum being much swollen and club-shaped. The terminal segment of the male antennæ is not hook-shaped.

I can discover but two important differences between *Gayella* and *Paramasaris*:—(1) The shape of the abdomen. In *Gayella* the first abdominal segment is nodiform, being rather short, although distinctly narrower than the second, as in certain species of *Pachymenes*. In *Paramasaris* the abdomen is more like that of typical *Eumenes*, the first segment being long, slender, and petioliform. (2) The third transverse cubital vein (R_3 of Bradley) in the fore wings is straight in *Paramasaris*; whereas in *Gayella* it is sharply bent, or geniculate, about the middle.

24. *GAYELLA MUTILLOIDES*, H. de Saussure, Et. Fam. Vesp. iii., Supplément, p. 114 (1856) (female). The holotype is a female from Chile. This species is quite distinct from *Gayella eumeneoides*, Spinola, contrary to the surmises made by v. Schulthess-Rechberg, Deutsche Ent. Zeitschr. p. 189 (1910)) and by Zavattari (Arch. f. Naturgesch. lxxviii. Abt. A, Heft 4, p. 7 (1912)).

MASARIDINÆ.

25. *MASARIS VESPIFORMIS*, Fabricius, subsp. *ÆGYPTIACUS*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) viii. p. 447 (1911) (male). The holotype is a male from Cairo. The collection also contains two females of this race from Jericho, but the female sex, so far as I know, is not yet described.

26. *QUARTINIA INDICA* (Cameron) = *Juartinia indica*, Cameron, Zeitschr. Syst. Hym. Dipt. iv. p. 89 (1904) (male). The holotype is a male from Deesa, India, which, however, bears a label "*Quartinia maculifrons*, Cam.," although, so far as I know, no such name has ever been used in print.

27. *CERAMIUS LICHTENSTEINII* (Klug) = *Gnatho lichtensteinii*, Klug, Magaz. Ges. Naturf. Fr. Berlin, iv. p. 36, pl. i. fig. 3 (1810) (female); *Ceramius rufo-maculatus*, Cameron, Trans. South African Phil. Soc. xvi. 4, p. 325 (1906) (female). The holotype of *C. rufo-maculatus* is a female from Pearston, Cape Province, which in the collection bears the label "*rufo-ornatus*, Cam." Cameron's species is identical with *C. lichtensteinii*, as was first pointed out by Brauns (Ent. Mitt. Berlin, ii. p. 194 (1913)), and this seems to have been recognized also by Meade-Waldo.

28. *JUGURTIA ESCALERÆ*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 33 (1910) (female). The holotype is a female from S.W. Persia.

29. *JUGURTIA SIMPSONI*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) viii. p. 448 (1911) (female). The holotype is a female from Patchari, Gambia.

29a. *CELONITES NURSEI*, Dover, Jl. Proc. Asiatic Soc. Bengal, N.S. ii. 6 (1924), p. 289, fig. 1 (1925) (female). The holotype is a female from Quetta, India.

EUPARAGINÆ.

30. EUPARAGIA MACULICEPS (P. Cameron) = *Plesiomasaris maculiceps*, P. Cameron, Trans. American Ent. Soc. xxx. p. 267 (1904) (male); *Odynerus (Epipona) simplicipes*, P. Cameron, Trans. American Ent. Soc. xxxi. p. 380 (1905) (male); *Odynerus (Epipona) vicarius*, W. A. Schulz, Spolia Hymenopterologica, p. 219 (1906); *Psiloglossa simplicipes*, Rohwer, Ent. News, xx. p. 357 (1909) (female). The holotype of *P. maculiceps* is a male from Mexico; the holotype of *O. simplicipes* is likewise a male from Mexico. The specific identity of these two insects, as to which there can be no doubt, was recognized by Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xiv. p. 404 (1914)). *O. vicarius* is but a new name introduced, quite unnecessarily, for *O. simplicipes*, Cameron (not *Pterochilus simplicipes*, Herrich-Schaeffer, 1839 = *Odynerus levipes*, Shuckard, 1837). Among the additional specimens of *Euparagia maculiceps* recorded by Meade-Waldo from Guerrero, there are two females, which sex of the species was described by Rowher as *Psiloglossa simplicipes*, the identity of the specific name with that of Cameron's *Odynerus simplicipes* being merely fortuitous.

As recognized by Bradley and myself, the genus *Plesiomasaris*, Cameron, 1904, is identical with *Euparagia*, Cresson, 1879 (Bradley, Univ. of California Publ., Entomology, i. no. 9, p. 384 (1922)). Bradley was quite correct, though, in regarding *Euparagia maculiceps* as specifically distinct from *Euparagia scutellaris*, Cresson. Through an oversight he calls Cresson's species "*maculifrons*" in the key (1922, p. 384). Bradley also examined the holotype of *Psiloglossa simplicipes*, Rohwer.

RAPHIGLOSSINÆ.

31. RAPHIGLOSSA RUFESCENS (E. Saunders) = *Raphidoglossa rufescens*, E. Saunders, Trans. Ent. Soc. London, p. 402 (1905) (male and female). The holotype is a male from Biskra. One of the females from Biskra should be selected as allotype, and there are several more paratypes, of both sexes, from the same locality.

32. RAPHIGLOSSA NATALENSIS, F. Smith, p. 8, pl. i. fig. 4 (1857) (female). The holotype is a female without locality.

33. RAPHIGLOSSA FLAVO-ORNATA (P. Cameron) = *Rhaphiglossa flavo-ornata*, P. Cameron, Trans. South African Philos. Soc. xv. 4, p. 231 (1905) (female); *Rhaphidoglossa punctata*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 34 (1910) (male), and (8) viii. p. 449 (1911) (female). The holotype of *R. punctata* is a male without locality-label, although it was described from Angola. The allotype should be selected from among the several females of the Lower Luangwa River, N.E. Rhodesia. In a later paper (Ann. & Mag. Nat. Hist. (8) xi. p. 45 (1913)), Meade-Waldo concluded that his *R. punctata* was synonymous with

Cameron's *flavo-ornata*, and there can be little doubt that he was correct. The type of Cameron's species, however, was not seen by Meade-Waldo, and it is not at the British Museum.

34. *PSILIGLOSSA ALGERIENSIS* (E. Saunders) = *Psiloglossa algeriensis*, E. Saunders, Trans. Ent. Soc. London, p. 400 (1905) (male and female). The holotype is a male from Biskra; the allotype from the same locality; and one female paratype.

Of *Raphiglossa eumenoides*, S. Saunders, and *Psiloglossa odyneroides* (S. Saunders) there are in the British Museum series of specimens of both sexes from Albania. They were collected by S. Saunders and most probably are paratypes. The holotypes and allotypes, however, are at Oxford.

ZETHINÆ

35. *LABUS NATALENSIS* (H. de Saussure) = *Smithia natalensis*, H. de Saussure, Rev. Mag. Zool. (2) vii. p. 371 (1855) (male); *Labus maculicollis*, P. Cameron, Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro, ii. Abt. S, Hym., 6, Vesp. p. 181 (1910) (female and male) (not *Labus maculicollis*, J. Bequaert, 1918); *Labus annulatus*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 36 (1910) (female and male). The holotype of *Smithia natalensis* is a male from Port Natal. The holotype of *Labus maculicollis* is a female from Kibonoto, Mt. Kilimanjaro. The holotype of *Labus annulatus* (marked "type") is a female from Durban (which is the same locality as Port Natal); of the remaining specimens from Durban, which served for the original description of *L. annulatus*, one of the males should be selected as the allotype—the other specimens (one female and three males) being paratypes.

Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xi. p. 51 (1913)) studied one of the "cotypes" of *Labus maculicollis* which Cameron returned to the Stockholm Museum. He concluded that *Labus adelphus*, Meade-Waldo, was a synonym of Cameron's species. I believe, however, that the specimen retained in Cameron's collection (now at the British Museum) should be regarded as the true holotype of *L. maculicollis*. I can find no structural differences between that specimen and the types of *Smithia natalensis* and *Labus annulatus*, so that I must regard these three specimens as belonging to one species. *Labus adelphus*, however, is structurally distinct, although closely allied.

Misled by Meade-Waldo's statement, I described and figured as *Labus maculicollis*, Cameron, a common wasp from the Belgian Congo, which is not Cameron's species, but *Labus adelphus*, Meade-Waldo.

From *Labus adelphus*, Meade-Waldo, *Labus natalensis* differs in the following peculiarities:—

(1) The shape of the first abdominal segment, which is gradually widened from the base to the apex, the apical margin being

not quite twice as wide as the base. In *L. adelphus*, the first segment widens rather suddenly behind the middle and the apical margin is distinctly over twice as wide as the base of the segment.

(2) The propodeum lacks the fine transverse ripples of *L. adelphus*, but instead bears a pair of sharp tubercles placed near the middle line, a short distance before the concavity.

(3) The puncturation of the two basal tergites of the abdomen is much finer than in *L. adelphus*.

(4) The tubercles at the base of the middle femora (male) are stronger, sharper, and more spine-like than in *L. adelphus*.

As I pointed out before (Bull. American Mus. Nat. Hist. xxxix. p. 43 (1918)), the petiolate second submarginal cell, on which H. de Saussure's genus *Smithia* (*Hymenosmithia*, Dalla Torre) was based, is a variable feature in this group and cannot be used as a valid generic character to separate *Smithia* from *Labus*. This is well demonstrated by a study of the series in the British Museum. In the types of *Smithia natalensis*, *Labus maculicollis*, and *Labus annulatus* the second submarginal cell is briefly petiolate. But among the other specimens that are morphologically like *L. natalensis* some have this cell sessile, others have it provided with a long stalk.

I am inclined to believe that *Labus natalensis* is strictly East and South African. I have seen it from the following localities:—

Tanganyika Territory: Kibonoto, Mt. Kilimanjaro, 1000 to 1300 m. (*Sjöstedt*).

Angola, one male.

Natal: Port Natal (or Durban) (*F. Muir*); Lower Tugela River (*E. Reynolds*).

36. *LABUS ADELPHUS*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) viii. p. 452 (1911) (male) = *Labus maculicollis*, J. Bequaert, Bull. American Mus. Nat. Hist. xxxix. p. 49 (male and female), figs. 26–31 (not of Cameron) (1918). The holotype of *Labus adelphus* is a male from Mabira, Uganda. As I explained above, I regard it as specifically distinct from *L. natalensis*. The description and figures which I have given of it, under the erroneous name *L. maculicollis*, will help to identify it.

L. adelphus is, in my opinion, a species of the West African subregion, known to me from the following localities:—

Cameroon: Lolodorf (*A. I. Good*, Carnegie Mus.).

Belgian Congo: Faradje and Stanleyville (*Lang* and *Chapin*); Malela, Lukula, Lubutu, and Rutshuru (*J. Bequaert*); Congo da Lemba (*Mayné*); Bambili (*Rodhain*). Some of these specimens were recorded as *L. maculicollis* by Dr. H. Schouteden (Rev. Zool. Afric. vi. p. 173 (1919)).

Uganda: Mabira (*G. C. Gowdey*); between the Seziwa River and Kampala (*S. A. Neave*).

37. *LABUS ANNULIPES*, P. Cameron, Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro, ii. Abt. 8, Hym., 6, Vesp. p. 182 (1910)

(male) = *Labus fragilis*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) viii. p. 453 (1911) (female and male). The holotype (marked "type") of *L. fragilis* is a female from the Lower Luangwa River, N.E. Rhodesia; the allotype (not marked "type") is a male from Buluwayo. G. Meade-Waldo, who examined a specimen of *Labus annulipes* sent by the Stockholm Museum, concluded that his *L. fragilis* was a synonym of that species. There is no type-specimen of Cameron's species in the British Museum.

In 1918 (Bull. American Mus. Nat. Hist. xxxix. p. 49) I suggested that *L. annulipes*, Cameron, might possibly be identical with *Labus macrostylus*, Kohl (= *Micreumenes curriei*, Ashmead); but in this I was mistaken. The following peculiarities will help one to recognize both sexes of *Labus annulipes*: The first abdominal segment is extremely long and slender, forming a narrow petiole which is about the length of the head, thorax, and propodeum combined and much longer than the second tergite; it is considerably longer and narrower than in *L. macrostylus*; seen from above it is but slightly widened posteriorly, being almost parallel-sided; in profile it is almost equally thick over its whole length. The thorax is elongate and narrow; the pronotum projects on each side into very sharp spinose lateral angles; mesonotum much longer than wide; postscutellum without spines. Propodeum with a long horizontal area behind the postscutellum, which is even longer than in *L. garambensis*, Bequaert, but is regularly rounded off behind; this horizontal median area is convexly swollen without even a trace of a longitudinal groove, not bordered on the sides, with coarse puncturation, but not reticulate; the posterior concavity is deep, bordered on each side by a thick lamella, ending in the usual sharp spine above the valvulae; in profile this lateral lamella is not distinctly bidentate, though somewhat produced above the terminal tooth. In the male, the first abdominal sternite lacks the patch of white hairs of *L. macrostylus* and there are no transverse ripples in the hind portion of the second sternite; as in *L. macrostylus*, however, the base of the middle femora is not tuberculate, but bears a patch of greyish hairs on the underside; the antennae are wanting. In both holotype and allotype, the second submarginal cell is long and petiolate (as in fig. 20, p. 47, of my 1918 Revision).

L. annulipes appears to be a widely distributed East African species. In addition to the types of *L. fragilis*, I have seen it from the following localities:—

Abyssinia: Higo Samula (*R. J. Stordy*).

North-West Rhodesia: Chilanga (*R. C. Wood*).

Southern Rhodesia: Buluwayo (*G. Arnold*).

Nyasaland: Mlanje (*S. A. Neave*).

38. *LABUS RUFIPETIOLATUS*, A. v. Schulthess, Societas Entomologica, xxviii. p. 1, fig. (1913) (male). This is represented at the British Museum by several males from Willowmore, all of which I regard as paratypes. The true holotype was designated in the

original description as a specimen from "Kapland" in the South African Museum, Cape Town. I have seen this holotype (male) and it bears the locality-label "Cape Town." Moreover, the specimen from Willowmore marked "type" at the British Museum is a female, and that sex was not mentioned in the original description and, so far as I know, has not yet been described.

The striking coloration of this little wasp is not a reliable specific character, for I have seen at least two other South African species of *Labus* that likewise have a rufous-red first abdominal segment. I may add to A. v. Schulthess's excellent description that the two raised, flattened, transverse spines of the postscutellum are characteristic of the species in both sexes. In the male the first sternite bears no patch of hairs, the second sternite lacks transverse ripples, and the middle femora are without patch of hairs or prominent tubercle at the base. The head is unusually swollen in both sexes, being quite long seen from above. In all the specimens which I have examined, the second submarginal cell is broadly sessile, not petiolate.

✓ 39. *LABUS PUNCTATUS*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 37 (1910) (male). The holotype is a male from the Kangra Valley, Punjab.

✓ 40. *LABUS INTERSTITIALIS* (P. Cameron) = *Zethus interstitialis*, P. Cameron, Journ. Bombay Nat. Hist. Soc. xiv. p. 291 (1902) (female and male). There are two specimens labelled "*Zethus interstitialis*" and marked "types," viz., a female and a male from Matheran, N. India. The female may be selected as the holotype, the male as the allotype. As recognized by Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xiv. p. 404 (1914)), they represent a species of *Labus*. I believe that *L. interstitialis* is closely allied to, although specifically distinct from, *L. humbertianus*, H. de Saussure.

The species enumerated under Nos. 35 to 40 belong to the genus *Labus*, as defined by me in 1918 (Bull. American Mus. Nat. Hist. xxxix. pp. 41-45).

41. *MACROCALYMMA ALICIÆ*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) xiv. p. 459 (1914) (female). The holotype is a female from Yallingup, S.W. Australia. Although Meade-Waldo does not mention the fact, the species is structurally quite distinct from *M. smithianum*, Perkins, which is likewise represented in the British Museum. The shape of the first abdominal segment is totally different: in *M. aliciae* short and much swollen, but one and one-half times as long as high in profile, with short basal stalk; in *M. smithianum* more slender, twice as long as high in profile, with long basal stalk. The tegulae are somewhat coarsely punctate in *M. smithianum*, remotely and quite finely in *M. aliciae*.

42. *ELIMUS MACKAYENSIS*, G. Meade-Waldo, Ann. & Mag. Nat.

Hist. (8) v. p. 39 (1910) (female). The holotype is a female from Mackay, Queensland. There is also a male from the same locality, but, since that sex is thus far undescribed, it cannot be regarded as the allotype.

Elimus, H. de Saussure (Et. Fam. Vesp. i. p. 7 (1852)), was a monotypic genus for *E. australis*, H. de Saussure, with which *E. mackayensis* is certainly congeneric. In both species the first abdominal segment forms a narrow petiole, distinctly swollen about the middle and in general shape not so very different from that of the American *Zethus mexicanus* (Linnæus) or the African *Zethus delagoensis*, A. v. Schulthess. The second abdominal segment is distinctly narrowed at the base into a brief neck, which is but little shorter than in *Z. delagoensis*, and even longer than in *Z. mexicanus*. I fail to see how *Elimus* and *Zethus* (proper) can be separated on the strength of the shape of the abdomen.

In my key to the African genera of Vespidae (Bull. American Mus. Nat. Hist. xxxix. p. 26 (1918)), the alternative of couplet 7 ("Abdominal petiole narrow and slender at its base, strongly and abruptly swollen in its posterior half, club-shaped") could not be applied to *Elimus australis*. It rather describes the shape of the first segment in *Discaelius zonalis* (Panzer)

43. *ISCHNOCELIA ROBUSTA* (G. Meade-Waldo) = *Elimus robustus*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 40 (January 1910) (female). The holotype is a female from S. Australia. According to Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xiv. p. 459 (1914)), *Stenolabus vulneratus*, A. v. Schulthess, Deutsche Ent. Zeitschr. p. 191 (March 1910) (female and male), is a synonym.

44. *ISCHNOCELIA FERRUGINEA* (G. Meade-Waldo) = *Elimus ferrugineus*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 38 (1910) (male). The holotype is a male from S. Australia.

45. *ISCHNOCELIA INTEGR*A (A. v. Schulthess), var. MAJOR, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) xiv. p. 459 (1914) (female and male). The holotype is a female (marked "type") from Yallingup, S.W. Australia. A male from the same locality should be selected as the allotype.

46. *ZETHUS ARABICUS* (G. Meade-Waldo) = *Elimus arabicus*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 40 (1910) (female). The holotype is a female from Tajura, Straits of Babel-Mandeb. This locality is not in Arabia, but on the African continent, in French Somaliland.

Z. arabicus is a widely-distributed East and South African wasp, which may be separated from the other Ethiopian species of *Zethus* by the following characters: In the female the clypeus is broadly rounded off anteriorly; the apical margin straight, not emarginate, but preceded by a deep transverse depression, the bottom of which is slightly raised on the middle line; the surface with a few scattered punctures, which are almost completely hidden

by the dense white pubescence. Temples swollen behind the eyes, with a distinct, though obtuse, vertical ridge about the middle in their upper half. Pronotum broadly truncate, the anterior margin not carinate nor raised, the lateral angles prominent and sharply triangular. Propodeum with abruptly sloping ventral (lateral) areas, which, however, are not separated by carinae from the dorsal areas; the concavity not bordered by ridges, but gradually passing into the dorsal areas; the sculpture hidden by dense appressed hairs. Mesopleura with a carina behind the anterior epinemia. First abdominal segment very long and slender, slightly longer than the thorax (including the propodeum) and much longer than the second tergite, widest a little before the middle, where it is also thicker than elsewhere; its posterior half parallel-sided; close to the base and just behind the insertion of the extensory muscle, the middle line is raised into a blunt triangular tubercle, placed lengthwise. In profile the first tergite is bluntly projecting a short distance before its apex. Second segment with a distinct basal neck. Middle tibiae with two spurs. Most of these characters are also present in the male; but in that sex the apical margin of the clypeus is more rounded off. I have seen *Z. arabicus* from the following localities:—

Tanganyika Territory: Itigi (*G. D. H. Carpenter*), one female and one male. The male I designate as the allotype of the species.

Zululand: Mfongosi (*W. E. Jones*), one male.

Cape Province: Taumasetse (*Dr. Penther*), one female; Algoa Bay (*Dr. H. Brauns*), one female and one male.

There can be little doubt that *Z. arabicus* is the same species as *Zethus favillaceus*, F. Walker (List of Hym. collected by J. Lord, p. 28 (1871)), also of Tajura; but Walker's type is, I believe, no longer in existence.

47. *ZETHUS DELAGOENSIS*, A. v. Schulthess, Bull. Soc. Vaudoise Sc. Nat. (4) xxxv. p. 270 (1899) (female)=*Discælius transvaalensis*, Bingham, Ann. & Mag. Nat. Hist. (7) x. p. 218 (1902) (female). The holotype of *Discælius transvaalensis* is a female from Lydenberg District, eastern Transvaal. It is undoubtedly conspecific with *Zethus delagoensis*, of which there is in the British Museum a female from Rikatla, Delagoa, identified by v. Schulthess. Although that specimen is labelled "cotype," it is not even a paratype, since *Zethus delagoensis* was originally described upon a single female from Delagoa.

To A. v. Schulthess's description may be added that the temples lack the raised median ridge of *Z. arabicus*. The concavity of the propodeum is not bordered above by a carina, but is rounded off into the dorsal areas. Middle tibiae with two spurs. The male, of which I have seen several specimens, is very similar to the female; the antennal hook is moderately long, flattened, and slightly widened beyond the middle, ending in an obtuse curved point. I have seen the species from the following localities:—

Southern Rhodesia: Lonely Mine, Matabeleland (*H. Swale*), one female and two females.

Transvaal: Lydenburg District (*Zutrzenka*), one female.

Portuguese East Africa: Rikatlá; Lorenzo Marques; and Delagoa Bay (*Junod*), two females and one male.

48. *ZETHUS PUBESCENS*, F. Smith, p. 9 (1857) (female). The holotype is a female from Port Natal. This species is allied to *Zethus delagoensis*, but somewhat smaller. In both sexes it differs in the shape of the first abdominal segment, which is much more slender and but moderately swollen in its anterior third. A striking peculiarity is the presence of a fine longitudinal ridge on either side of the concavity of the propodeum, separating it from the dorsal areas; the ventral areas also are separated by a ridge from the dorsal areas; the concavity bears heavy transverse striæ. Temples without raised median ridge. Middle tibiæ with two spurs.

Zethus pubescens appears widely distributed in South Africa. I have seen it also from Caia on the Zambesi River, Portuguese East Africa (*H. Swale*; several females and males), and from Mfongosi, Zululand (*W. E. Jones*; one female).

It should be noted that I have seen specimens of several additional undescribed specimens of *Zethus* from the Ethiopian Region, most of them closely allied to *Z. delagoensis*. At least four distinct species occur in Rhodesia.

49. *ZETHUS AURULENS*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 121, pl. vi. fig. 5 (1856) (male) = *Zethus carinicollis*, P. Cameron, Entomologist, xl. p. 80 (1907) (male); *Zethus fulvohirtus*, P. Cameron, Entomologist, xl. p. 63 (1907) (female); *Zethus lamellicollis*, P. Cameron, Entomologist, xl. p. 62 (1907) (male). *Zethus aurulens* was described upon a male from Brazil, in F. Smith's collection. At the British Museum there is a male labelled "*aurulens*," from Rio Tapajoz. Although it is not marked "type," I believe it to be the true holotype, since it came from Smith's collection and agrees in every respect with de Saussure's description and figure.

The holotype of *Z. carinicollis* is a male from Mexico, that of *Z. fulvohirtus* a female from Nicaragua, that of *Z. lamellicollis* a male from Mexico. After a careful study, I can find no structural differences among these several specimens and *Z. aurulens*.

The most characteristic feature of *Z. aurulens* is the presence on each side of the pronotum of a longitudinal carina running from the edge of the anterior collar-shaped margin halfway to the tegulæ. The middle tibiæ have two apical spurs.

50. *ZETHUS PUNCTINODUS*, P. Cameron, Entomologist, xl. p. 79 (1907) (male). The holotype is a male from Mexico. Although closely allied to *Z. aurulens*, H. de Saussure, it appears specifically distinct. The first abdominal tergite has a much shorter stalk-like basal portion than in that species, while the mesonotum is more closely punctured. In addition, *Z. punctinodus* lacks the carinæ along the sides of the pronotum.

51. *ZETHUS DUBIUS*, F. Smith, p. 13 (1857) (female and male). The holotype is a male (marked "type") from Villa Nova, Brazil. The allotype is a female from the same locality (not marked "type").

52. *ZETHUS CARINATUS*, F. Smith, p. 13 (1857) (male). The holotype is a male from Villa Nova, Brazil.

53. *ZETHUS SCULPTURALIS*, F. Smith, p. 11 (1857) (male). The holotype is a male from Ega, Brazil.

54. *ZETHUS STELLARIS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 94 (1913) (male). The holotype is a male labelled "Tunantins," Brazil. I suspect that this is a clerical error for Tocantins.

55. *ZETHUS INORNATUS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 103 (1913) (female). The holotype is a female from Amula, Guerrero, Mexico.

56. *ZETHUS PIPIENS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 102 (1913) (female). The holotype is a female from Hacienda de la Imagen, Guerrero, Mexico.

57. *ZETHUS GUERREROI*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 89 (1913) (female). The holotype is a female from Acapulco, Guerrero, Mexico.

58. *ZETHUS YUCATANENSIS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 115 (1913) (female). The holotype is a female from N. Yucatan.

59. *ZETHUS BINGHAMI*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 114 (1913) (female and male). The holotype (marked "type") is a female from Savana Grande, Guerrero, Mexico; the allotype (marked "cotype"), a male from Dos Arroyos, Guerrero, Mexico.

60. *ZETHUS LONGISTYLUS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 117 (1913) (male). The holotype is a male from Obidos, Brazil.

61. *ZETHUS LÆVINODUS*, F. Smith, p. 17 (1857) (female) = *Zethus nitidinodus*, P. Cameron, Entomologist, xl. p. 81 (1907) (male). The holotype of *Z. lævinodus* is a female from Mexico, that of *Z. nitidinodus* a male from Mexico. I am unable to find specific differences between these two specimens.

Z. lævinodus has much the general appearance of the West Indian *Z. jurinei*, H. de Saussure, with which it is often confused. These two species, however, differ in several morphological features, as I shall point out in a forthcoming paper on the West Indian Diploptera. Suffice it to say that the middle tibiae bear two spurs in *Z. lævinodus* and but one spur in *Z. jurinei*. Another closely allied species is *Zethus atripennis*, Zavattari, which I have not yet seen. According to the description, however, it is quite distinct.

62. *ZETHUS GRACILIS*, F. Smith, p. 17 (1857) (male). The holotype is a male from Mexico.

63. *ZETHUS ORANS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 99 (1913) (female and male). Zavattari described this species from two localities in Brazil: S. Catharina and Alto da Serra, São Paulo. He failed, however, to designate the type-locality. In the British Museum there is but one female, from Alto da Serra, marked "cotype." For the present I must regard it as a paratype.

64. *ZETHUS CURIALIS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 97 (female and male). Of the four specimens of the original lot, three are in the British Museum. The holotype is a female from Corcovado, Rio de Janeiro (marked "type"). Of the two other specimens (marked "cotype"), the male from Corcovado is herewith selected as the allotype; the female from Guaruja being a paratype.

65. *ZETHUS CORCOVADENSIS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 105 (1913) (female and male). This was described from a pair from Corcovado, Rio de Janeiro: the female (marked "type") is the holotype; the male (marked "cotype") is the allotype.

66. *ZETHUS TORQUATUS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 93 (1913) (male). The holotype is a male from Brazil.

67. *ZETHUS GAUDENS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 112 (female). The holotype is a female from Corcovado, Rio de Janeiro.

68. *ZETHUS ANALIS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 106 (1913) (female). The holotype is a female from Tierra Colorada, Guerrero, Mexico.

69. *ZETHUS ISTHMICUS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 96 (1913) (female). The holotype is a female from Bugaba, Panama.

70. *ZETHUS PRECANS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 101 (1913) (male). The holotype is a male from Santarem, Brazil.

71. *ZETHUS SILVESTRIS*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 95 (1913) (female). The holotype is a female from Valladolid, Yucatan.

72. *ZETHUS AZTECUS*, H. de Sassaure, Rev. Mag. Zool. (2) ix. p. 270 (1857) (sex not indicated) = *Zethus campestris*, Zavattari, Arch. f. Naturgesch. lxxix. Abt. A, Heft 1, p. 108 (1913) (female and male). *Z. campestris* was described from four specimens of Rincon, Guerrero, Mexico. The holotype is the female now marked "type." One of the males must be selected as allotype.

In the collection, these specimens were all placed under *Z. aztecus*, probably by the late G. Meade-Waldo. There can be but little doubt that this synonymy is correct. Of the same species there are several more specimens from various localities in Guerrero. One of these, a male from Omilteme, was named *Z. aztecus* by Zavattari. Finally, there is a female from F. Smith's collection, labelled "*Z. aztecus*" and taken at Tampico, the type-locality of de Saussure's species. Possibly that specimen is a paratype of *Z. aztecus*, of which the holotype, however, is not in the British Museum.

73. *ZETHUS PALLIDUS*, F. Smith, p. 11 (1857) (female). The holotype is a female from Santarem, Brazil.

74. *ZETHUS MATZICATZIN*, H. de Saussure, Rev. Mag. Zool. (2) ix. p. 271 (1857) (male) = *Zethus erythrogaster*, P. Cameron, Entomologist, xl. p. 79 (1907) (female). The holotype of *Z. erythrogaster* is a female from Mexico. Although I did not see H. de Saussure's type, I regard *Z. erythrogaster* as conspecific with *Z. matzicatzin*, of which there are in the British Museum several specimens, some of them named by Zavattari.

75. *ZETHUS SMITHII*, H. de Saussure, Et Fam. Vesp. iii., Suppl. p. 122 (1856) (female). The holotype is a female bearing a locality-label "Java?" As was surmised by H. de Saussure, the species is South American. Zavattari saw a female from Bogotá, Colombia.

76. *ZETHUS ALBOPICTUS*, F. Smith, p. 15 (1857) (female). The holotype is a female from Santo Domingo. Although closely allied to *Z. jurinei*, H. de Saussure, it is really quite distinct from that species, as well as from *Z. laevinodus*, F. Smith. It will be fully discussed in a forthcoming paper. The middle tibiae bear two spurs.

77. *ZETHUS CARBONARIUS*, F. Smith, p. 10 (1857) (female). The holotype is a female from the Amazon River.

78. *ZETHUS FERRUGINEUS*, H. de Saussure, Et. Fam. Vesp. i. p. 14 (1852) (female). The holotype is a female from Pará, Brazil. The male, which appears to be undescribed, is represented in the British Museum by a specimen from Santarem, Brazil.

79. *ZETHUS LOBULATUS*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 116, pl. vi. fig. 4 (1856) (female) = *Baoprymna rufo-ornata*, P. Cameron, Timehri Journ. Agric. Soc. Brit. Guiana, (3) ii. p. 225 (1912) (no sex given). The holotype of *B. rufo-ornata* is a female from British Guiana. As recognized by G. Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xiv. p. 404 (1914)) it is conspecific with *Z. lobulatus*. I have not seen de Saussure's type.

80. *ZETHUS STRIGOSUS*, H. de Saussure, Smithsonian. Miscell. Coll. no. 254, p. 42 (1875) (female and male) = *Zethus jortistriolatus*,

P. Cameron, Entomologist, xl. p. 82 (1907) (female). The holotype of *Z. fortistriolatus* is a female from Nicaragua. Although I have not seen de Saussure's type, I feel quite certain that Cameron's name is a synonym of *Z. strigosus*.

81. CALLIGASTER DOLOSUS (Bingham) = *Zethus dolosus*, Bingham, Fauna of Brit. India, Hym. i. p. 333, fig. 91 (1897) (female). The holotype (marked "type") is a female without locality-label. The species was originally described from Burma (Pegu Hills) and from Tenasserim.

82. CALLIGASTER CYANOPTERUS, H. de Saussure, Et. Fam. Vesp. i. p. 23, pl. ix. fig. 7 (1852) (female) = *Zethus erythrostomus*, P. Cameron. Cameron's *Z. erythrostomus* is a manuscript-name given to a female from Lawang, Eastern Java. The specimen is the well-known *Calligaster cyanopterus*, as recognized by G. Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xiv. p. 404 (1914)).

83. CALLIGASTER ETCHSELLSII (P. Cameron) = *Zethus etchellsii*, P. Cameron, Entomologist, xlii. p. 206 (1909) (male). The holotype is a male from Kuching, Borneo. This is quite a distinct species in the shape of the clypeus, which is unusually wide (twice as broad as high) and ends in a deep semi-elliptic emargination. It is, however, allied to *C. cyanopterus*, with which it agrees in having the terminal segment of the male antenna straight, not hook-shaped nor folded beneath the apex of the flagellum.

84. CALLIGASTER HIMALAYENSIS (P. Cameron) = *Zethus himalayensis*, P. Cameron, Zeitschr. Syst. Hym. Dipt. iv. p. 13 (1904) (female). The holotype is a female from Sikkim. Although similar to *C. cyanopterus*, it appears to differ in the shape of the clypeus and is possibly a valid species.

85. CALLIGASTER VARIPUNCTATUS (P. Cameron) = *Zethus varipunctatus*, P. Cameron, Journ. Straits Asiatic Soc. xxxvii. p. 110 (1902) (male). The holotype is a male from Sarawak. There is also a female in the collection, but that sex appears as yet undescribed.

86. CALLIGASTER QUADRIDENTATUS (P. Cameron) = *Zethus quadridentatus*, P. Cameron, Entomologist, xxxv. p. 314 (1902) (female). The holotype is a female from Borneo. Although closely allied to *C. varipunctatus*, it appears to be specifically distinct.

The species enumerated under Nos. 81 to 86 have the first abdominal segment of much the same general shape and might be placed in *Calligaster*, if that group be accepted as a valid genus.

87. CALLIGASTER TRIMACULATUS (P. Cameron) = *Zethus trimaculatus*, P. Cameron, Zeitschr. Syst. Hym. Dipt. iv. p. 14 (1904) (female). The holotype is a female from Darjeeling.

88. CALLIGASTER TURNERI, G. Meade-Waldo, Ann. & Mag.

Nat. Hist. (8) v. p. 35 (1910) (female). The holotype is a female from Shillong, Assam. Although allied to *C. trimaculatus* (Cameron), it appears specifically distinct.

The shape of the first abdominal segment of the two foregoing species is quite different from that of most of the other Oriental Zethinæ. I am inclined to believe that these two might be placed in the genus *Discælius*, rather than in *Calligaster*. Dover (Jl. Proc. Asiat. Soc. Bengal, N.S. xx. 6 (1924), p. 291 (1925)) reached the same conclusion with regard to *C. turneri*.

89. *DISCÆLIUS INSIGNIS*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 126 (1856) (female). The holotype is a female bearing an old hand-written label "W. Imeson, N. Holland."

90. *DISCÆLIUS CABINATUS*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 38 (1910) (female). The holotype is a female from Victoria.

91. *DISCÆLIUS MERULA*, Haliday, Trans. Linn. Soc. London, xvii. 3, p. 325 (1836) (female). The holotype is a female from Chile. This species occurs in three colour-forms:—

a. Typical form: Body entirely black (except part of the legs).

b. Var. *SPINOLÆ*, H. de Saussure = *Discælius spinolæ*, H. de Saussure, Et. Fam. Vesp. i. p. 25 (1852) (female). Only the second abdominal segment with a narrow, pale yellow fascia at the apex.

c. Var. *CHILENSIS* (Spinola) = *Epipona chilensis*, Spinola, in Gay, Hist. Fis. Chile, Zool. vi. p. 248 (1851) (female). Both first and second abdominal tergites with a narrow, pale yellow fascia at the apex.

EUMENINÆ.

In the present paper I am using the generic names *Eumenes*, *Nortonia*, and *Pachymenes*, as defined by me in 1918 (Bull. American Mus. Nat. Hist. xxxix. pp. 90–94). For a characterization of the subgenera of *Eumenes*, my paper in the 'Annals of the South African Museum,' xxiii. 1926, should be consulted (pp. 485–489).

92. *PACHYMENES PULCHELLUS* (H. de Saussure) = *Discælius pulchellus*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 127 (1856) (female and male). The holotype (marked "type") is a female from Mexico. The male from "Jamaica," in the collection, appears to be the allotype, although it is not marked "co-type." As suspected by Zavattari (Arch. f. Naturgesch. lxxviii. Abt. A, Heft 4, p. 76 (1912)), this little wasp is not related to *Discælius*. It is not one of the Zethinæ, but belongs in the subfamily Eumeninæ, owing to the decussate, slender, beak-like mandibles. It will be fully discussed in a forthcoming paper on the West Indian Diploptera.

93. *PACHYMENES JOHNSONI* (P. Cameron) = *Eumenes johnsoni*, P. Cameron, *Invertebrata Pacifica*, i. p. 185 (1907) (female). The holotype is a female from Belize. This is one of the larger species of *Pachymenes*.

94. *PACHYMENES SPILONOTUS* (P. Cameron) = *Eumenes spilonotus*, P. Cameron, *Nova Guinea*, v. 1, p. 65 (1906) (female). The species was originally described from two females of Sentani and Manokwari, New Guinea. In the British Museum only the female from Manokwari is extant and marked "type." This specimen may be selected as the holotype. It appears to be a species of *Pachymenes*. Since I was unable to examine the mouth-parts, there is, however, a possibility that it is a *Montezumia*. There are no carinae nor teeth on the propodeum; the first abdominal segment is narrowed at the base into a distinct stalk, which is hardly shorter than the cup-shaped apical portion of the tergite.

95. *NORTONIA CAFFRA* (G. Meade-Waldo) = *Labus caffra*, G. Meade-Waldo, *Ann. & Mag. Nat. Hist.* (8) viii. p. 453 (1911) (female). The holotype is a female from Zululand. The species is allied to *Nortonia gambiensis* (Meade-Waldo) (syn.: *Nortonia acarophila*, J. Bequaert), having the same deep oval acarid chamber in front of the concavity of the propodeum. Nevertheless, it is quite distinct. The sculpture of the mesonotum is coarser, almost reticulate. The propodeum is longer behind the postscutellum, more densely punctured, and its horizontal portion (in front of the acarid chamber) is not longitudinally grooved, but a little raised in the middle. First abdominal tergite with one transverse carina, which is a little less than half the width of the apical margin of the tergite (in *N. gambiensis* the carina is slightly over half that width), and raised as a sharp crest, with a triangular tooth on the middle line and projecting sharp lateral edges. The horizontal portion of the first tergite (behind the carina) is decidedly longer and narrower at the base than in *N. gambiensis*. The clypeus of the female is a little more broadly emarginate at the apex than in *N. gambiensis*. Length of holotype (h. + th. + t. 1+2) 9 mm. The male, of which I have seen two specimens from Durban, Natal, is similar to the female, but the clypeus is quite deeply emarginate, bifid at the apex.

96. *NORTONIA GAMBIENSIS* (G. Meade-Waldo) = *Labus gambiensis*, G. Meade-Waldo, *Ann. & Mag. Nat. Hist.* (8) viii. p. 454 (1911) (female); *Nortonia acarophila*, J. Bequaert, *Bull. American Mus. Nat. Hist.* xxxix. p. 97, figs. 81-84 (1918) (female). The holotype of *Labus gambiensis* is a female from Dunajoe, Gambia. A comparison with the description and a paratype of my *Nortonia acarophila* shows conclusively that these two insects are conspecific.

N. gambiensis is, I believe, a West African species, replaced in East and South Africa by the allied *N. caffra*. In the original

account of *Labus gambiensis*, Meade-Waldo referred to that species a female from Nyasaland; but I did not find that specimen placed with the type of *gambiensis* in the collection. I suspect that Meade-Waldo eventually found that it was not conspecific.

97. *NORTONIA SWALEI* (G. Meade-Waldo) = *Labus swalei*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) viii. p. 451 (1911) (female and male). The holotype (marked "type") is a female from the Nubian Desert (between Korosko and Abu Hamed). The male from the same locality should be selected as the allotype. This is one of the smaller species of the genus, measuring not quite 6 mm. from the clypeus to the tip of the second tergite. The first abdominal segment is unusually narrow, quite slender near the base, where it bears a transverse dorsal carina, projecting as teeth on the sides. Meade-Waldo had this wasp compared with *Labus chudeaui*, R. du Buysson, but that species appears to be a true *Labus*.

97 a. *NORTONIA CAMPANULATA* (Wickwar) = *Labus campanulata*, Wickwar, Spolia Zeylanica, v. pt. xix. p. 121, pl. figs. 10-18 (1908) (female). The holotype is a female from Ceylon. As recognized by Dover (Jl. Proc. Asiatic Soc. Bengal, N.S. xx. 6 (1924), p. 297 (1925)), this is a true *Nortonia*.

98. *NORTONIA PARVILINEATA* (P. Cameron) = *Eumenes parvilineata*, P. Cameron, Zeitschr. Syst. Hym. Dipt. iv. p. 12 (1904) (female). The holotype is a female without locality. It was described from Sikhim. The collection contains a female of the same species from Shillong, Assam.

99. *EUMENES POMIFORMIS* (Fabricius) = *Vespa pomiformis*, Fabricius, Spec. Insect. i. p. 467 (1781) (sex not indicated); *Labus superbus*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 36 (1910) (male). The holotype of *Labus superbus* is a male from the White Nile, with a very old locality-label. The synonymy was published by me in 1926 (Ann. South African Mus. xxiii. 3, pp. 501-502), and also by Dover in 1925 (Jl. Proc. Asiatic Soc. Bengal, N.S. xx. 6 (1924), p. 292).

100. *EUMENES QUADRATUS*, F. Smith, Trans. Ent. Soc. London, (2) ii. p. 37 (1852) (female and male). This species is represented at the British Museum by two specimens, both labelled "type." I select as the holotype the female from Shanghai, since it agrees best with Smith's description. *E. quadratus* is then characterized by the peculiarly duplicated apical margin of the second abdominal tergite, where the terminal lamella is much raised into a collar, so that the tergite ends in a deep groove. In the British Museum there is a male (not seen by F. Smith) presenting the same peculiarity, and which I therefore regard as the true male of *E. quadratus*. I have in my collection a female of *E. quadratus* from Hanoi, Indo-China (*V. Demange*).

Smith's supposed allotype of *E. quadratus* is a male from Ning-Po-Foo, which is not conspecific with the holotype, since it lacks the deep groove near the apex of the second tergite. It belongs to a different species, which most probably has been described since Smith's time, so that I refrain from naming it anew.

101. *EUMENES MICADO*, P. Cameron, Entomologist, xxxvii. p. 35 (1904) (female) = *Eumenes samuray*, A. v. Schulthess, Mitt. Schweiz. Ent. Ges. xi. 7, p. 284 (1908) (male and female). The holotype of *E. micado* is a female from Japan, which does not differ from the description of *E. samuray*, nor from two specimens in the British Museum Collection determined as *E. samuray* by A. v. Schulthess. The two specimens, a female (received from v. Schulthess as the "type") and a male (labelled "cotype") from Japan, are, I presume, paratypes of *E. samuray*. That species was described from three males and seven females, so that most probably the true holotype and allotype were retained for the author's collection.

I strongly suspect that this species will eventually prove the same as *E. japonicus*, H. de Saussure (Rev. Mag. Zool. x. p. 164 (1858) (female)). At any rate, the description of that species fits perfectly the specimens I have seen of *E. micado* and *E. samuray*. Since there are, however, a number of closely allied species of the subgenus *Eumenes* proper in the Sino-Japanese area, the correct status of the names published in this group must be left in abeyance for the present.

102. *EUMENES PUNCTATUS*, H. de Saussure, Et. Fam. Vesp. i. p. 37 (1852) (female and male). The holotype is a female from China. The male allotype, which was also described by de Saussure, is not to be found in the British Museum.

103. *EUMENES MACROPS*, H. de Saussure, Et. Fam. Vesp. i. p. 41 (1852) (sex not indicated). The holotype is a male from Warm Springs, North Carolina (*E. Doubledayi*). This species is generally placed in the synonymy of *E. fraternus*, Say, evidently following H. de Saussure's somewhat doubtful suggestion (Smithson. Miscell. Coll. no. 254, p. 95 (1875)). A careful study, however, shows it to be extremely close to, if not identical with, *E. globulosus*, H. de Saussure (Et. Fam. Vesp. iii., Suppl. p. 139 (1856) (female)). The type of that species should also be in the British Museum, since it was sent to de Saussure by F. Smith; but I was unable to find it. In the holotype of *E. macrops*, the wings are but slightly smoky, almost clear; the body-markings are creamy white and the legs more or less tinged with ferruginous; there is a creamy-white dot about the middle on each side of the first tergite (or petiole); but there are no lateral spots on the second tergite and the tergites 3 to 7 are without apical fasciae. I have seen true *E. globulosus* with lateral spots on the first tergite and the spots on the disk of the second tergite are often quite small in the males.

104. *EUMENES SMITHII*, H. de Saussure, Et. Fam. Vesp. i. p. 48 (1852) (female and male). The holotype is a male from St. John's Bluff, Florida. It agrees with the current conception of that well-known species.

105. *EUMENES VERSICOLOR*, H. de Saussure, Et. Fam. Vesp. i. p. 71 (1852) (no sex indicated). The holotype is a female without locality. H. de Saussure described it as doubtfully from America. He later referred it as a variety to *E. abdominalis* (Drury), but evidently without examining his type (Smithson. Miscell. Coll. no. 254, p. 106 (1875)). For *E. versicolor* has nothing in common with *E. abdominalis*, since the holotype shows it to belong to the subgenus *Eumenes* proper, having a duplicate apical margin to the second tergite; while *E. abdominalis* has the apical margin simple and belongs in the subgenus *Delta*. I suspect that *E. versicolor* is allied to *E. pictus*, Smith.

106. *EUMENES PICTUS*, F. Smith, p. 32 (1857) (male). The holotype is a male from Santo Domingo. Like the foregoing species, this wasp belongs in *Eumenes* proper, with duplicate apical margin of the second tergite. Evidently misled by Smith's comparison with *E. colona*, H. de Saussure thought it was a mere colour-form of *E. abdominalis* (Drury), which, however, belongs in a different subgenus. I am inclined to regard *E. cubensis*, Cresson (syn.: *E. ferruginea*, Cresson), as identical with *E. pictus*, which quite possibly is the same as *E. versicolor*, E. de Saussure. This group of species will be more fully discussed in a forthcoming paper on West Indian Diploptera.

107. *EUMENES LUCASIUS*, H. de Saussure, Et. Fam. Vesp. i. p. 68 (1852) (male) = *Rethus* [*lapsus* for *Zethus*] *broomi*, P. Cameron, Rec. Albany Mus. i. 2, p. 110 (1904) (male). The holotype of *R. broomi* is a male from Pearson, Cape Province. As recognized by Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xiv. p. 404 (1914)), it is a synonym of *E. lucasius*. See Ann. South African Mus. xxiii. 3, pp. 514-517 (1926).

108. *EUMENES ASSAMENSIS*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 41 (1910) (female and male). The holotype is a female from Shillong, Assam; the allotype is a male from the same locality.

The species enumerated under Nos. 99 to 108 all belong to the subgenus *Eumenes* proper.

109. *EUMENES NICARAGUAENSIS*, P. Cameron, Invertebrata Pacifica, i. p. 104 (1905) (male). The holotype is a male from Chinandega, Nicaragua.

110. *EUMENES BELTI*, P. Cameron, Invertebrata Pacifica, i. p. 186 (1907) (male). The holotype is a male from Chinandega, Nicaragua.

111. *EUMENES ACAPULCENSIS*, P. Cameron, Timehri, Jl. Agr.

Soc. Brit. Guiana, (8) ii. p. 280 (1912) (sex not indicated). The holotype is a female from Acapulco, Mexico. The locality is not mentioned in the original account.

112. *EUMENES ROTUNDICOLLIS*, P. Cameron, Timehri, Jl. Agr. Soc. Brit. Guiana, (8) ii. p. 229 (1912) (male). The holotype is a male from British Guiana.

113. *EUMENES OCTOMACULATUS*, P. Cameron, Timehri, Jl. Agric. Soc. Brit. Guiana, (8) ii. p. 229 (1912) (female). The holotype is a male from British Guiana.

The type of *E. demararaensis*, P. Cameron (Timehri, Jl. Agric. Soc. Brit. Guiana, (8) ii. p. 228 (1912) (female)), is not to be found at the British Museum. There is, however, a female from British Guiana, labelled *Eumenes brunneimaculatus*, P. Cameron, a name which does not appear to have been used in print. Perhaps that specimen is the holotype of *E. demararaensis*, which then would be closely allied to the two foregoing species.

114. *EUMENES FOXI*, W. A. Schulz, Hymenopteren-Studien, p. 109 (1905) (female). A female, from Belem, Pará, Brazil, received from W. A. Schulz, is marked "type," but evidently is a paratype only.

115. *EUMENES AUROPILOSUS*, F. Smith, p. 30 (1857) (male). The holotype is a female from Villa Nova, Brazil. The abdomen is missing.

116. *EUMENES PLACIDUS*, F. Smith, Trans. Ent. Soc. London, (3) p. 37 (1862) (male). The holotype is a male without locality-label. The species was described from Panama.

The species enumerated under Nos. 109 to 116 all belong to the subgenus *Omicron*.

117. *EUMENES MELANOSOMA*, var. *DECIPIENS* (Kirby) = *Eumenes decipiens*, W. F. Kirby, Ann. & Mag. Nat. Hist. (6) xviii. p. 265 (1896) (sex not indicated). The holotype is a female from Ogowe. It agrees with my former interpretation of that form, which is a colour-variation of *E. melanosoma* (see Bull. American Mus. Nat. Hist. xxxix. p. 82 (1918), and Ann. South African Mus. xxiii. 8, p. 528 (1926)).

Of *Eumenes moseri*, W. A. Schulz ('Spolia Hymenopterologica,' p. 315 (1906) female) there are in the British Museum four females from Fernando Po, received from W. A. Schulz and labelled "type." They evidently are but paratypes. They fully substantiate my former conclusion that *E. moseri* is identical with *E. decipiens*.

118. *EUMENES MELANOSOMA*, var. *ÆTHIOPICUS* (H. de Saussure) = *Eumenes æthiopicus*, H. de Saussure, Et. Fam. Vesp. i. p. 62 (1852) (female). The holotype is a female labelled "Congo." *E. melanosoma* is the only representative of the subgenus *Afreumenes*. I published accounts of its several colour-forms in

1918 and in 1926, and some additional notes will be presented in a forthcoming paper.

119. *EUMENES LEPTOGASTER*, F. Walker, List of Hym. collected by J. Lord, p. 30 (1871) (sex not indicated). A male (marked "type"), of Wady Ferran (which is in the Sinai Peninsula), appears to be the holotype. The collection also contains two more males and one female of this extraordinary species.

Although it is a true solitary wasp of the genus *Eumenes*, owing to the single spur of the middle tibia and the dentate tarsal claws, yet it reminds one of *Belonogaster* and *Paramischocyttarus* in the peculiar shape of the abdomen. It is the most slender of all *Eumenes* known to me. The first abdominal segment is extremely long and narrow, while the second is narrowed at the base into a long stalk. The apical margin of the second tergite is simple and the last segment of the male antenna is recurved and hook-shaped.

I suspect that *Ischnogasteroides flavus*, Magretti (Ann. Mus. Civ. Genova, xxi. p. 606, fig. (1884) (female)), from Northern Abyssinia, is extremely close to *E. leptogaster*. Possibly the name *Ischnogasteroides* might be retained for a subgeneric division of *Eumenes*, to contain such extremely slender species (see Ann. South African Mus. xxviii. 3, p. 488 (1926)).

120. *EUMENES ARBUSTORUM* (Panzer) = *Vespa arbustorum*, Panzer, Fauna Insect. German. vi. pt. 63, pl. v. (1799) (sex not indicated); *Eumenes arbustorum*, subsp. *alyira*, W. A. Schulz, Hymenopteren-Studien, p. 45 (1905) (female). A female, from Iambèse, received from W. A. Schulz as "type," is evidently but a paratype. I cannot separate it from typical *E. arbustorum*—not even as a colour-variety. The late G. Meade-Waldo appears to have been of the same opinion.

121. *EUMENES LENTIS*, Bingham, Fauna of British India, Hym. i. p. 347 (1897) (female). The holotype is a female from Rangoon, Burma.

122. *EUMENES WALTONI*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 42 (1910) (female and male). The holotype is a female from Gyang-tse, Tibet; the allotype, a male from the same locality.

123. *EUMENES INSULARIS*, F. Smith, p. 27 (1857) (female and male) = *Eumenes ovalauensis*, H. de Saussure, Stettin. Ent. Zeitg. xxx. p. 53 (1869) (female); *Belonogaster bidentata*, W. F. Kirby, Ann. & Mag. Nat. Hist. (5) xiii. p. 410 (1884) (described as a female). The holotype of *E. insularis* is a female without locality; the allotype is a male of the original lot. This species was described from the "Solomon Isl. or New Hebrides." The holotype of *Belonogaster bidentata* is a male from Fiji (not a female, as stated in the original description). A comparison of these types shows that *B. bidentata* is the same species as

E. insularis. Meade-Waldo (Ann. & Mag. Nat. Hist. (8) v. p. 42 (1910)) synonymized *B. bidentata* with H. de Saussure's *E. ovalauensis*, described from Ovalau, one of the Fiji (or Viti) Islands. This synonymy appears correct, although not based upon an examination of H. de Saussure's type. *Eumenes insularis* agrees in coloration with *E. pyriformis*, var. *circinalis* (Fabricius), but it is a distinct and valid species, more closely allied to *E. philantes*, H. de Saussure.

124. *EUMENES FLUCTUANS*, H. de Saussure, Et. Fam. Vesp. i. p. 43 (1852) (female). The holotype is a female without locality. It was described as from Australia. The species is structurally distinct from both *E. bicinctus*, H. de Saussure, and *E. pyriformis*, var. *latreillei*, H. de Saussure.

125. *EUMENES PHILANTES*, H. de Saussure, Et. Fam. Vesp. i. p. 54 (1852) (female). The holotype is a female labelled "N. Holl." Although coloured like *E. pyriformis*, var. *latreillei*, and *E. bicinctus*, it differs in structure from both these species and appears to be more closely allied to *E. campaniformis* (Fabricius).

126. *EUMENES MAXILLOSUS* (de Geer), var. *TROPICALIS* (H. de Saussure) = *Eumenes tropicalis*, H. de Saussure, Et. Fam. Vesp. i. p. 54 (1852) (female). The holotype is a female from Sierra Leone. It agrees with the current interpretation of this form.

127. *EUMENES PYRIFORMIS* (Fabricius), var. *NIGRITARIS* (G. Meade-Waldo) = *Eumenes nigratarsis*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 43 (1910) (male). The holotype is a male from Port Darwin, Northern Australia. The female, which was not described by Meade-Waldo, is also in the British Museum from the same locality. This is one of the colour-forms of *E. pyriformis* (Fabricius).

128. *EUMENES PYRIFORMIS* (Fabricius), var. *LATREILLEI* (H. de Saussure) = *Eumenes latreillei*, H. de Saussure, Et. Fam. Vesp. i. p. 51, pl. x. fig. 5 (1852) (female); *Eumenes latreillei petiolaris*, W. A. Schulz, Berlin. Ent. Zeitschr. xlix. 1904, p. 217 (1905) (female). A female of *petiolaris*, from Finschhafen, former German New Guinea, received from W. A. Schulz as a "type," is evidently but a paratype. I cannot see that it deserves to be separated by name from *latreillei*. It differs merely in the presence of a small, oblique, preapical, black spot on each side of the first abdominal tergite.

129. *EUMENES PYRIFORMIS* (Fabricius), var. *PHILIPPINENSIS*, new name = *Eumenes maxillosus*, var. *fulvipennis*, J. Bequaert, Ann. South African Mus. xxiii. 3, pp. 562 & 563 (1926) (female and male) (not *Eumenes fulvipennis*, F. Smith, 1857). An examination of Smith's type shows that my interpretation of his *E. fulvipennis* was erroneous (see below). The Philippine wasp,

which I believed to represent *E. fulvipennis*, therefore needs re-naming. It was briefly defined in the key to the colour-phases of *E. maxillosus*, which I published in 1926. I subjoin a more extended description.

Female.—Almost entirely pitch-black, the thorax and anterior segments of the abdomen practically without ferruginous. Labrum pale brown; a yellowish line along the outer orbits; a line along the inner orbits (below the sinus of the eye) and a spot between the antennæ, yellowish or more orange; extreme apical edges of first tergite slightly ferruginous; antennæ ferruginous-red; abdominal sternites 5 and 6 more or less ferruginous or orange; the foregoing sternites often suffused with ferruginous. Apices of femora, tibiæ, and tarsi of the fore legs extensively ferruginous; the last tarsal segment of all legs with a ferruginous or orange spot. Wings coloured much as in *circinalis*, but the black or brownish base not quite so extensive. Length (h. + th. + t. 1 + 2) 25 to 26 mm.

Male.—Similar to the female. Clypeus entirely orange-yellow; legs more extensively ferruginous; the ferruginous also extends over much of the ventral side of the abdomen and sometimes forms a transverse band over the middle of the first tergite. The second to fourth segments of the middle tarsi are conspicuously widened and flattened on the hind (or outer) side, so that they appear lobate. Length (h. + th. + t. 1 + 2) 23 to 24 mm.

The holotype is a female from Manila, Philippine Islands, and the allotype a male from the same locality (*M. B. Mitzmain Coll.*), both in my collection. The United States National Museum contains many additional paratypes, of both sexes, from the following localities in the Philippine Islands:—Mt. Makiling, Luzon (*C. F. Baker Coll.*); Los Baños, Luzon (*F. X. Williams Coll.*; *E. M. Ledyard Coll.*); Manila (*W. A. Stanton Coll.*); Zamboanga, Mindanao (*E. A. Mearns Coll.*); Dasmariñas, Cavite Province (*John Heil Coll.*); Culasi Panay and Batbatan Island (*McGregor Coll.*).

Up to the present, I regarded *Eumenes pyriformis* (Fabricius) and its several colour-phases of the Oriental Region as mere colour-variations of the Ethiopian *E. maxillosus* (de Geer). A more careful study of the males, however, shows that *E. pyriformis* is specifically distinct. The flattened shape of the middle tarsi of the male, with their conspicuous lobate expansion, separates it at once from *E. maxillosus*, where the middle tarsi are perfectly normal; in *E. pyriformis* the middle femora are deeply concave in the basal third in the male; the antennal hook seems to differ slightly. In the female, there appears to be a difference in the propodeum: in *E. maxillosus*, the ventral and dorsal areas are separated by a more or less distinct (often sharp) ridge in their posterior half, so that the roughly granulate dorsal area is sharply divided from the smooth ventral area; in *E. pyriformis*, there is no such ridge, the sides of the propodeum being rounded off everywhere, while the rough sculpture of the dorsal area invades the upper (or posterior) edge of the ventral area.

On the strength of these characters, I regard *circinalis*, Fabricius, *philippinensis*, Bequaert, *latreillei*, H. de Saussure, *nigritarsis*, G. Meade-Waldo, and *xanthurus*, H. de Saussure, as colour-phases of *Eumenes pyriformis* (Fabricius) (= *Vespa petiolata* Fabricius). On the other hand, the following colour-forms belong to *E. maxillosus* (de Geer): *savignyi*, Guérin, *reginus*, H. de Saussure, *dimidiatipennis*, H. de Saussure, *conicus*, Fabricius, *fenestralis*, H. de Saussure, and *tropicalis*, H. de Saussure. I have examined males of all these forms. Those of *circinalis*, *latreillei*, *pyriformis*, and *conicus* were sent to me from the U.S. National Museum by Mr. S. A. Rohwer. Through the courtesy of Prof. J. C. Bradley, I have also seen the male of *conicus*, *pyriformis*, and *circinalis* in the collections of Cornell University.

130. *EUMENES CAMPANIFORMIS* (Fabricius), var. *FORMOSUS* (H. de Saussure) = *Eumenes formosa*, H. de Saussure, Et. Fam. Vesp. i. p. 55 (1852) (sex not indicated); *Eumenes granti*, W. F. Kirby, Bull. Liverpool Mus. iii. p. 18 (1900) (female). A female of *E. formosa*, labelled "Congo," at the British Museum, I take to be the true holotype, since H. de Saussure states that his specimen came from the "Musée de Londres." It is not marked "type" at present. It agrees with my recent interpretation of the name (Ann. South African Mus. xxiii. 3, p. 546 (1926)).

A female of *E. granti*, from Socotra, labelled "type," is possibly the true holotype of that species. If I am correct in this surmise, *E. granti* will be a synonym of *E. campaniformis*, var. *formosus*, and not of the typical form of *Eumenes lepeleterii*, H. de Saussure, as I had believed thus far. We must await the examination of males from Socotra in order to settle this point.

131. *EUMENES CAMPANIFORMIS* (Fabricius), var. *CAMERONI*, new name = *Eumenes fulvipennis*, P. Cameron, Jl. Bombay Nat. Hist. Soc. xvii. p. 1008 (1907) (male and female) (not *Eumenes fulvipennis*, F. Smith (1857)). Of the three specimens of *E. fulvipennis*, Cameron, labelled "type" at the British Museum, I designate the male from Deesa as the holotype, the female from Deesa as allotype, and the female from Bombay as paratype. They represent a peculiar colour-phase of *E. campaniformis*, as demonstrated by the shape of the petiole in both sexes and by the antennal hook of the male.

This colour-phase corresponds to H. de Saussure's varieties B. and C. of *Eumenes esuriens* (Et. Fam. Vesp. i. pp. 56 & 57 (1852)). Seemingly restricted to the drier or desert regions of North-western India, Persia, and Arabia, it appears well worthy of a varietal name. It is remarkable for the extension of the yellow colour over thorax and abdomen, the mesonotum being spotted with yellow or almost completely yellow. In the British Museum there are also specimens of the var. *cameroni* from Muscat.

132. *EUMENES CAMPANIFORMIS* (Fabricius), var. *HIGLETTI* (G. Meade-Waldo) = *Eumenes higletti*, G. Meade-Waldo, Ann. &

Mag. Nat. Hist. (8) v. p. 43 (January 1910) (female); *Eumenes campaniformis*, var. *marshalli*, J. Bequaert, Ann. South African Mus. xxiii. 3, p. 548 (1926) (female and male). The holotype of *E. higletti* is a female from Tamsoo, Gold Coast. This *Eumenes* was one of the few forms that I was unable to recognize when I wrote my recent revision of the Ethiopian species of the genus. The type shows all the morphological peculiarities of *E. campaniformis*. It is evidently the colour-form which I described as var. *marshalli*.

In a previous paper I have given my reasons for suspecting that *E. maxillosus*, var. *pulcherrimus*, A. v. Schulthess ('Societas Entomologica,' xxv. p. 17 (March 1910) (female), is identical with *Eumenes higletti*, Meade-Waldo. Meade-Waldo's name, although published the same year, has several weeks' priority.

133. *EUMENES CAMPANIFORMIS* (Fabricius), var. *RENDALLI* (Bingham) = *Eumenes rendalli*, Bingham, Ann. & Mag. Nat. Hist. (7) x. p. 220 (1902) (female only). The holotype is the female from Fort Johnston, Nyasaland. I have redescribed it in detail (Ann. South African Mus. xxiii. 3, p. 551 (1926)). Bingham's supposed male belongs to *E. lepeleterii*, var. *concinus*, H. de Saussure.

134. *EUMENES ARCUATUS* (Fabricius), var. *NICOBARICUS* (G. Meade-Waldo) = *Eumenes nicobarica*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 41 (1910) (described as a male). The holotype (marked "type") and two paratypes are females from the Nicobar Islands. Meade-Waldo stated that he described the species from three males, but all the specimens in the British Museum are females.

135. *EUMENES ARCUATUS* (Fabricius), var. *DAMMÆ* (Dalla Torre) = *Eumenes walkeri*, W. F. Kirby, Ann. & Mag. Nat. Hist. (6) xiv. p. 108 (1894) (male) (not *E. walkeri*, Ritsema, 1874); *Eumenes dammæ*, Dalla Torre, Genera Insect., Vesp. p. 22 (1904). The holotype is a male from Damma Island.

136. *EUMENES ARCUATUS* (Fabricius), var. *FULVIPENNIS* (F. Smith) = *Eumenes fulvipennis*, F. Smith, p. 24 (1857) (female and male). The holotype is a female, and the allotype a male, both from Celebes. As suspected by H. de Saussure (Stettin. Ent. Zeitg. xxiii. p. 179 (1862)), it is a colour-phase of *E. arcuatus*.

The opportunity may be used to present a key to the several described forms which I regard as colour-phases of *Eumenes arcuatus* (Fabricius):—

1. Thorax entirely black or at most with a median spot on the pronotum 2.
- Thorax with several yellow, orange-yellow, or ivory-white markings 3.
2. Abdomen marked as in typical *arcuatus*; the first tergite with yellow spots; the second tergite

- with two pale yellow fasciæ, which are more or less interrupted in the middle (at least the first one) [Saussure).
 Var. *blanchardi* (H. de
 Abdomen black, except for four yellow spots on the first tergite, which sometimes may be absent [Smith).
 Var. *fulvipennis* (F. [pictus Blanchard).
 3. Yellow markings of mesonotum lyre-shaped, consisting of two complete hooks Var. *praslinius* (Guérin) (syn. : *flavo-*
 The lyre-shaped markings of the mesonotum divided into four elongate spots 4.
 4. Second abdominal tergite almost wholly yellow, except for the extreme base and a small, elongate, median, black spot [Waldo).
 Var. *nicobaricus* (Meade-
 Second abdominal tergite with transverse yellow fasciæ 5.
 5. The two fasciæ of the second tergite very broad, continuous, connected on the sides; first tergite extensively yellow [Torre).
 Var. *dammæ* (Dalla
 The two fasciæ of the second tergite narrow and more or less interrupted in the middle (at least the first one); first tergite with small yellow spots only Typical [(Fabricius).
E. arcuatus

Fabricius's type of *Vespa arcuata* was examined by me in the Banksian Collection at the British Museum.

137. *EUMENES CURVATUS*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 145, pl. viii. fig. 1 (1856) (described as a female) = *Eumenes inflexus*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 145 (female). In the collection of the British Museum there is a male from the Philippines labelled "*E. curvatus*" and marked "type." At some later date a label was added reading, "believed to be the type." The doubt must have originated from the fact that H. de Saussure described the type of *E. curvatus* as a female. I believe, however, that this was due to an oversight, and that the above-mentioned male is the true holotype. I am prompted to this conclusion by de Saussure's statement with regard to the tarsal claws of his *E. inflexus* (see below). Although closely allied to *E. arcuatus* (Fabricius), *E. curvatus* is a valid species characterized by a number of morphological features. The punctuation of the thorax is superficial, the integument being shiny, which is not true of *E. arcuatus*. The first abdominal segment (petiole) is fully as long as head and thorax and more strongly curved than in *E. arcuatus* (in which the petiole is somewhat shorter). Clypeus arcuately emarginate at the apex. The terminal hook of the antenna in the male is very long, curved, and sharp, pale-coloured beneath. In general coloration *E. curvatus* is much like *E. arcuatus*, var. *fulvipennis*, but there are never any yellow spots on the petiole and the wings are black with a steel-blue tinge. In the supposed male holotype of *E. curvatus* the head bears some ivory-white markings not mentioned in the original description: a fine line along the outer orbits and another along the inner orbits (beneath the sinuses of the eyes), a spot on the interantennal carina, and a longitudinal spot over the middle of the clypeus.

The holotype of *E. inflexus* is a female labelled "Cayenne?", but H. de Saussure suspected that the locality-label was erroneous. Together with this specimen is placed a female from "Phil. Isl.," bearing a label "*Eumenes incurvus*, Sauss.," probably a *lapsus* for *E. inflexus*, since, so far as I know, no such name was published by H. de Saussure. A careful comparison of the types of *E. curvatus* and *E. inflexus* fails to disclose any but sexual differences. The peculiarity in the shape of the tarsal claws, mentioned by H. de Saussure, is a sexual character in the genus *Eumenes*, and, in my opinion, indicates that his *E. curvatus* was based upon a *male* specimen.

I have seen several other females of *E. curvatus* from the Philippine Islands and Northern Borneo. In coloration they differ little from the males; but the median spot of the clypeus and the spot between the antennæ are absent.

There is in the British Museum a female *Eumenes* from Lawang, Eastern Java, bearing a manuscript-name by Cameron, who dedicated the species to the collector, Mr. Buysman. Although the specimen is marked "type," the species was never described in print. It is coloured like *E. arcuatus*, var. *blanchardi*, but appears to be structurally different. Possibly it is identical with one of the many described, but unrecognized, *Eumenes* of the Oriental Region.

138. *EUMENES DYSCHERUS*, H. de Saussure, Et. Fam. Vesp. i. p. 50 (1852) (female) = *Eumenes centralis*, P. Cameron, Zeitschr. Syst. Hym. Dipt. vi. p. 128 (1906) (female). The holotype of *E. dyscherus* is a female without locality-label. The holotype of *E. centralis* is a female from Panama. I have fully discussed this species in Bull. Brooklyn Ent. Soc. xx. pp. 134-138 (1925). A. v. Schulthess recently wrote me that he saw in H. de Saussure's collection, at the Geneva Museum, a male labelled "*E. dyscherus*." It may be well to point out that this specimen cannot possibly be the type, since H. de Saussure had before him but the female of the British Museum, when he wrote the original description.

139. *EUMENES CANALICULATUS* (Olivier) = *Vespa canaliculata*, Olivier, Encycl. Méthod. Insect. p. 672 (1791); *Eumenes lineatifrons*, P. Cameron, Timehri, Jl. Agric. Soc. Brit. Guiana, (3) ii. p. 227 (1912) (female). The holotype of *E. lineatifrons* is a female from British Guiana. As recognized by Meade-Waldo (Ann. & Mag. Nat. Hist. (8) xiv. p. 404 (1914)), it is conspecific with *E. canaliculatus*.

The species enumerated under Nos. 119 to 139 all belong to the subgenus *Delta*.

140. *EUMENES EDWARDSII*, H. de Saussure, Et. Fam. Vesp. i. p. 60, pl. xi. figs. 4 & 4 a-b (1852) (female) = *Eumenes ichnogastroides*, Wickwar, Spolia Zeylanica, v. pt. xix. p. 119, pl. fig. 9 (1908) (sex not indicated). In the British Museum there is a specimen, in rather poor condition, from Nedunkerni, Ceylon,

labelled as the type of *E. ichnogastroides*. It appears to be a female, and may be regarded as the holotype of that species. There is also a male of the same species, received from Wickwar and marked "duplicate of type." These two specimens show that *E. ichnogastroides* is identical with *E. edwardsii*, which is also represented in the British Museum by a long series of specimens of both sexes from North-western India: Deesa, Nasik, Mysore, etc.

E. edwardsii is readily recognized by the peculiar shape of the abdomen, which reminds one of the African *E. phthisicus*, Gerstaecker. The first abdominal segment is unusually slender and the second segment is narrowed at the base into a distinct stalk. In the male the antennæ are composed of thirteen segments, but the last segment is minute and punctiform (not hook-shaped), which places *E. edwardsii* in my subgenus *Oreumenes*.

141. *EUMENES DECORATUS*, F. Smith, Trans. Ent. Soc. London, (2) ii. 2, p. 36 (1852) (female and male) = *Eumenes sinensis*, F. Smith, in Brenchley, Cruise of H.M.S. 'Curaçoa' among the South Sea Islands, p. 462, pl. xlv. fig. 3 (1873) (female); *Eumenes fraternus*, F. Smith, Trans. Ent. Soc. London, p. 195 (1873) (female) (not of Say); *Eumenes fratercula*, Dalla Torre, Cat. Hym. ix. p. 24 (1894). The holotype of *E. decoratus* is a female labelled merely "N. China," although Smith gave Tein Tung as the type-locality. The holotype of *E. sinensis* is a male from "N. China." I feel quite certain that these two wasps are both sexes of one species. Owing to the last antennal segment of the male being small and punctiform, *E. decoratus* likewise belongs in my subgenus *Oreumenes*.

142. *PARAUMENES SUBLÆVIS* (F. Smith) = *Eumenes sublævis*, F. Smith, p. 23 (1857) (female). The holotype is a female from Sarawak. It belongs in the genus *Paraumenes* and is one of the species with spinose propodeum.

143. *PARAUMENES SANSIBARICUS* (W. A. Schulz) = *Eumenes* (*Paraumenes*) *sansibarica*, W. A. Schulz, Hymenopteren-Studien, p. 9 (1905) (female); *Paraumenes marshalli*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 45 (1910) (female). The holotype is a female from Salisbury, Southern Rhodesia. A careful comparison of this specimen with Schulz's quite detailed description of *E. sansibarica* leaves no doubt that the synonymy which I proposed in 1918 (Bull. American Mus. Nat. Hist. xxxix. p. 271) is correct. There are several other females of this species in the British Museum from the Upper Luangwa River, Northern Rhodesia (*S. A. Neave*), and Mr. Arthur Loveridge communicated to me several specimens taken at Kilosa, Tanganyika Territory.

I have also seen a specimen of another undescribed species of *Paraumenes* from Southern Rhodesia.

144. *PARAUMENES IMPERATRIX* (F. Smith) = *Eumenes imperatrix*, F. Smith, p. 24 (1857) (female). The holotype is a female

from Northern China. As recognized by G. Meade-Waldo (Ann. & Mag. Nat. Hist. (8) v. p. 46 (1910)), this is a *Pareumenes* and one of the species with spinose propodeum.

145. *PARAUMENES QUADRISPINOSUS* (H. de Saussure) = *Eumenes quadrispinosus*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 134, pl. vii. figs. 2-2g (1856) (female and male). A female from India, marked "type," may be taken as the holotype, although the species was described from a series of specimens.

146. *PARAUMENES AUSTRALENSIS* (G. Meade-Waldo) = *Eumenes* (*Pareumenes*?) *australensis*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) v. p. 44 (1910) (male). The holotype is a male from Kuranda, near Cairns, Queensland. The allotype, described in Ann. & Mag. Nat. Hist. (8) xiv. p. 460 (1914) is a female from the same locality. There are also several paratypes of both sexes.

147. *ANCISTROCERUS* (*HYPANCISTROCERUS*) *ADVENA* (H. de Saussure) = *Odynerus advena*, H. de Saussure, Et. Fam. Vesp. iii., Suppl. p. 222, pl. xi. figs. 3, 3a-b, and 4 (1856) (female). The holotype is a female from Santarem. I have discussed this interesting species in a former paper (Trans. American Ent. Soc. li. p. 62 (1925)).

148. *ANCISTROCERUS* (*PARANCISTROCERUS*) *BACU* (H. de Saussure) = *Odynerus bacu*, H. de Saussure, Et. Fam. Vesp. i. p. 185 (1852) (male); *Ancistrocerus variornatus*, P. Cameron, Primer Informe Annal. Est. Cent. Agric. Cuba, p. 283 (1906) (male). Of *Ancistrocerus variornatus* there are at the British Museum two males from the Cameron collection, and taken by F. C. Baker at Havana. They are not labelled "type," and I am inclined to believe that they are paratypes. They are identical with the common *A. bacu* of Cuba.

149. *ANCISTROCERUS QUEBECENSIS*, P. Cameron, Trans. American Ent. Soc. xxxii. p. 333 (1906) (male) = *Odynerus monteregalis*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) xiv. p. 405 (1914) (new name for *Odynerus canadaensis*, Cameron, not of H. de Saussure). The holotype is a male from Montreal, which was labelled "*canadaensis*" in Cameron's collection, but was not described under that name. I believe that it is but the common North American *Ancistrocerus tigris* (H. de Saussure), although I was unable, for lack of time, to settle the matter.

150. *ODYNERUS BAIRSTOWI*, Gribodo, Bull. Soc. Ent. Italiana, xxiii. p. 292 (1891) (female) = *Odynerus* (*Ancistrocerus*) *gowdeyanus*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) viii. p. 457 (1911) (male). The holotype of *O. gowdeyanus* is a male from Entebbe. I am unable to separate it from *O. bairstowi*. This species is not an *Ancistrocerus* but an *Odynerus* of the subgenus *Rygychium*. The meeting-edge of the horizontal and vertical areas of the first tergite is slightly swollen, and this apparent

ridge is emphasized by the different colour of the two parts; but there is no true transverse carina along the edge. I have taken a male of *O. bairstowi* at Landana, Portuguese Congo.

151. *RHYNCHALASTOR FUSCIPENNIS*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) vi. p. 110 (1910) (female). The holotype is a female from Tanganyika Territory ("German East Africa"). The species is extremely close to *Rhynchalastor xanthosoma* (Schletterer), which I regard as its West African representative. *R. xanthosoma* lacks the dense ferruginous and somewhat golden pile which is a conspicuous feature of *R. fuscipennis*.

The shape of the second submarginal cell appears to vary too much in these wasps to be of more than specific value. Both species of *Rhynchalastor* are structurally quite close to *Odynerus ferruginatus*, Bequaert (syn.: *O. ferrugineus*, A. v. Schultess), except in the shape of the clypeus of the male and the presence of a rudimentary transverse carina on the first abdominal tergite. In some specimens of *O. ferruginatus* I have seen, the second submarginal cell is more distinctly petiolate than in *Rhynchalastor*. Possibly it might be more logical to regard *Rhynchalastor* as a subgenus of *Ancistrocerus*.

POLYBINEÆ.

152. *POLYBIOIDES MELAINA* (G. Meade-Waldo) = *Polybia* (*Parapolybia*) *melaina*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) vii. p. 110 (1911) (female and male). The holotype is a female from between Salt Lake and Wawamba, Western Uganda; the allotype, a male from the same locality.

153. *BELONOGASTER BUYSSEI*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) vii. p. 99 (1911) (female). The holotype is a female from Iganga Busoga, Uganda (not S. Nigeria, as stated by error in the original description).

POLISTINÆ.

154. *POLISTES FORTUNATUS*, W. F. Kirby, Ann. & Mag. Nat. Hist. (5) xiii. p. 410 (1884) (female). The holotype is a worker (or female) labelled "Cape Verdes," and there are in the collection several identical females and workers from the same locality. This wasp is quite different from any of the Palaearctic or African species of *Polistes* I have seen. It appears to be closely related to the North American *Polistes bellicosus*, Cresson, which also exists in the West Indies. Perhaps the species was accidentally introduced from America, as is the case with *Polistes aurifer*, H. de Saussure, in the Hawaiian Islands.

155. *POLISTES OCULATUS*, F. Smith, p. 111 (1857) (male). The holotype is a male from Mexico. This is a most remarkable wasp, owing to the very large swollen eyes, resembling those of the

drone in the honey-bee and of the males of certain species of *Xylocopa*. The character is unique in the genus *Polistes* so far as I know.

156. *POLISTES CRINITUS* (Felton), var. *AMERICANUS* (Fabricius) = *Vespa americana*, Fabricius, Syst. Entom. p. 370 (1775) (sex not indicated); *Polistes madoci*, W. F. Kirby, Ann. & Mag. Nat. Hist. (5) xiii. p. 411 (1884) (female). The holotype of *P. madoci* is a female from St. Thomas, West Indies. The collection also contains several paratypes from the same locality. Structurally it is like *P. crinitus*, and in coloration agrees with the var. *americanus* of that species.

157. *POLISTES SMITHII*, H. de Saussure, var. *TRISTIS* (G. Meade-Waldo) = *Polistes tristis*, G. Meade-Waldo, Ann. & Mag. Nat. Hist. (8) vii. p. 101 (1911) (female). The holotype is a female from Mombasa, and there are two paratypes from the same locality. These specimens have all the structural characters of *P. smithii*, an extremely variable wasp of East Africa and Madagascar. In coloration they are much like the Madagascan *P. smithii*, var. *bituberculatus* (R. du Buysson), from which they differ merely in having some rufous-red on the thorax and in the wings being less amber-yellow, with a conspicuously darkened radial cell. They evidently form the transition between the var. *bituberculatus* and the var. *madiburensis*, A. . Schulthess. It should be noted that some of the Madagascan *bituberculatus* have no apical fascia on the first tergite.

158. *POLISTES SMITHII*, H. de Saussure, var. *DEFECTIVUS* (Gerstaecker) = *Polistes defectiva*, Gerstaecker, Arch. f. Naturgesch. xxxvii. i. p. 351 (1871) (female); *Polistes waldoi*, Dover, Entomologist, lix. p. 36, fig. 1 (1926) (female). The holotype of *P. waldoi* is a female from Mlanje, 2300 ft., Nyasaland, and there are several paratypes from the same locality and from Namiwawa, Nyasaland. Structurally these specimens are *P. smithii*, and they have the coloration of the var. *defectivus*, perhaps the most widely-distributed form of that species.

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parvilineata, 98.
perkinsi, 18.
petiolarius, 128.
petiolata, 129.
philantes, 123, 125.
philippinensis, 129.
phthiarius, 140.
pictifrons, 21.
pictus, 105, 106.
pipiens, 56.
placidus, 116.
pomiformis, 99.
prælator, 7.
praslinus, 136.
precans, 70.
pubescens, 48.
pulchellus, 92.
pulcherrimus, 132.
punctata, 33.
punctatus, 39, 102.
punctinodus, 50.
pyriformis, 123, 124, 125, 127, 128, 129.
quadratus, 100.
quadridentatus, 86.
quadrispinosus, 145.
quebecensis, 149.
reginus, 129.
rendalli, 133.
robusta, 43.
rotundicollis, 112.
rufescens, 31.
rufipetiolatus, 38.
rufomaculatus, 27.
rufo-ornata, 79.
rufo-ornatus, 27.
samurai, 101.
sansibaricus, 143.
saussurii, 3.
savignyi, 129.
sculpturalis, 53.
scutellaris, 30.
silvestris, 71.
simplicipes, 30.
simpsoni, 29.
sinensis, 141.
smithianum, 41.
smithi, 2, 3, 75, 104, 157, 158.
sobrina, 10.
spilonotus, 94.
spinolæ, 91.
stellaris, 54.
strigosus, 80.
sublævis, 142.
superbus, 99.
sualei, 97.
tigris, 149.
torquatus, 66.
transvaalensis, 47.
tricolor, 2, 3.
trimaculatus, 87, 88.
tristis, 157.
tropicalis, 126, 129.
turneri, 88.
varicornatus, 148.
ruripunctatus, 85, 86.
venusta, 9.
versicolor, 105, 106.
vespiformis, 4, 25.
vicarius, 30.
vulneratus, 43.
walldoi, 158.
walkeri, 14, 135.
walloni, 122.
xanthosoma, 151.
xanthurus, 129.
yucatanensis, 58.
zonalis, 42.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

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XXI.—*South Indian Arachnology*.—Part III. By W. RAE SHERRIFFS, M.A., D.Sc., F.L.S., Professor of Zoology, University College, Southampton.

To the lists of species recorded in the previous paper (Ann. & Mag. Nat. Hist. ser. 9, vol. xix. pp. 533–542, May 1927) from our area—the Oriental generally—must be added:—

Uloboridae.

ULOBORUS (Latr.), 1806.

- | | |
|--|---------------------------|
| 13. <i>furunculatus</i> (Sim.), 1906. | Poona and Konkau. |
| 14. <i>hilaris</i> (Sim.), 1906. | Trichinopoly, Kodaikanal. |
| 15. <i>modestus</i> (Thor.), 1891. | Andamans. |
| 16. <i>oculatus</i> (Kulcz.). | Singapore. |
| 17. <i>pinnipes</i> (Thor.), 1877. | Celebes. |
| 18. <i>pictus</i> (Thor.). | Burma. |
| 19. <i>quadrituberculatus</i> (Thor.). | India, Java, Singapore. |
| 20. <i>raffrayi</i> (Sim.). | Singapore. |
| 21. <i>sinensis</i> (Sim.). | Peking. |
| 22. <i>tristis</i> (Kulcz.). | Java, Singapore. |
| 23. <i>undulatus</i> (Thor.). | Amboina. |
| 24. <i>zosi</i> (Walck.), 1837. | Tropics, Burma. |

Eresidae.

STEGODYPHUS (Sim.), 1873.

- | | |
|--|----------------|
| 1. <i>mirandus</i> (Poc.), 1899. | Western India. |
| <i>pacificus</i> (Poc.), 1900. | " " |
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3. *sarasinorum* (Karsch), 1892.
4. *socialis* (Poc.), 1900.
5. *tibialis* (O. P. Camb.), 1869.

Gujerat, S. India.
Bangalore, S. India.
Burma, S. India.

Hersiliidæ.

HERSILIA (Sav.), 1827.

1. *clathrata* (Thor.), 1895.
2. *pectinata* (Thor.), 1895.
3. *peguana* (Thor.), 1895.
4. *savignyi* (Luc.), 1836.

Burma.
Rangoon, Ceylon.
Burma.
Burma, India.

Pholcidæ.

ARTEMA (Walck.), 1837.

1. *atlantu* (Walck.), 1837.
2. *sisyphoides* (Dol.), 1857.

Ceylon, India.
Burma, Ceylon, India.

SMERINGOPUS (Sim.), 1890.

1. *elongatus* (Vin.), 1863.

Burma, Ceylon, India.

Theridiidæ.

THERIDION (Walck.), 1805.

24. *albomaculosum* (O. P. Camb.), 1869.
25. *annulipes* (O. P. Camb.), 1869.
26. *luteipes* (Camb.?).
27. *spiniventre* (O. P. Camb.), 1869.

Ceylon.
"
"
"

Argiopidæ.

TETRAGNATHA (Latr.), 1804.

The Indian fauna contains many species of this genus very much alike in appearance and habits. Pocock ('Fauna of British India, Arachnida, 1900, p. 214) selected three representative species, viz., *gracilis* (Stol.), *geniculata* (Karsch), and *mandibulata* (Walck.), each with a wide distribution.

More recently Gravely ('Some Indian Spiders of the Subfamily Tetragnathinæ,' 1921, pp. 424-446) has revised this group, recording twenty-eight species already described, and examining with great care and with excellent descriptive figures ten species, seven of which he finds to be new to science. In distinguishing the species two criteria are employed—the structure of the chelicerae and the eye-arrangement, especially the former, where it must be remembered that, as Comstock ('The Spider Book,' 1913, pp. 409-410) remarks, "in adults the teeth, especially near the apex of the chelicerae, vary in form, size, and spacing in the different

species, and are fairly constant; slight variations from the formulæ given in the specific descriptions occur."

Further, the Rev. O. Pickard Cambridge (Journ. Linn. Soc. vol. x. nos. 46 & 47, pp. 373-397, 1869 & 1870) long ago remarked:—"Notwithstanding the minute delineation of the falces of a number of species by Count Keyserling ('Beiträge zur Kenntniss der Orbitelæ, Latr.,' Wien, 1865), a careful and accurate monograph of the now rather extensive group of the genus [*Tetragnatha*] is required to present fairly and distinctly the specific differentiæ of its closely allied and similarly formed species."

Keyserling in his paper dealt with only fifteen species. Simon (Hist. Nat. des Araig. 1892, p. 722) notes about one hundred described to that date, and, with that number to-day at least trebled, how much more true becomes the passage from Cambridge above quoted!

In the lists of localities given both by Pocock and Gravely I find no mention of Coorg, where during my short visits in December 1918, and again in April 1919, I met with no spiders of this genus, the following species of which have been recorded from our area and the East generally:—

- | | |
|---|---------------------------|
| 1. <i>anguilla</i> (Thor.), 1877. | Celebes. |
| 2. <i>armata</i> (Karsch), 1891. | Ceylon. |
| 3. <i>biseriata</i> (Thor.), 1881. | Amboina. |
| 4. <i>chauliodus</i> (Thor.), 1890. | Burma, Penang, Singapore. |
| 5. <i>cochinensis</i> (Gravely), 1921. | Cochin. |
| 6. <i>calestis</i> (Poc.), 1901. | Assam. |
| 7. <i>delumbis</i> (Thor.), 1891. | Nicobars. |
| 8. <i>determinata</i> (Karsch), 1891. | Ceylon. |
| 9. <i>extensa</i> (Linn.), 1761. | Sumatra. |
| 10. <i>fallax</i> (Thor.), 1881. | Amboina. |
| 11. <i>flagellans</i> (van Hass.), 1882. | Sumatra. |
| 12. <i>fletcheri</i> (Gravely), 1921. | Shillong. |
| 13. <i>foliifera</i> (Sim.), 1897? | Mahé. |
| 14. <i>foveata</i> (Karsch), 1891. | Ceylon. |
| 15. <i>foveolata</i> (Karsch). | " |
| 16. <i>fronto</i> (Thor.), 1890. | Sumatra. |
| 17. <i>geniculata</i> (Karsch), 1892. | Burma, Ceylon, India. |
| 18. <i>gracilis</i> (Stol.), 1869= <i>ceylonica</i> (O. P. C.)= <i>latifrons</i> (Thor.). | Burma, Ceylon, India. |
| 19. <i>gracillima</i> (Thor.), 1890 [<i>Limorera</i>]. | Sumatra. |
| 20. <i>gulosus</i> (L. Koch). | Chatham Islands. |
| 21. <i>hamata</i> (Thor.), 1898. | Burma, Ceylon. |
| 22. <i>hasseltii</i> (Thor.), 1890. | Celebes. |
| 23. —, var. <i>birmanica</i> (Thor.), 1895. | Burma. |
| 24. <i>irridescens</i> (Stol.), 1869. | Calcutta. |
| 25. <i>japonica</i> (Büs. & Str.). | Japan. |
| 26. <i>jejeuna</i> (Thor.), 1890. | Burma. |
| 27. <i>latifrons</i> (Thor.), 1877= <i>gracilis</i> (Stol.). | Celebes. |
| 28. <i>lea</i> (Str.). | Japan. |
| 29. <i>leptognatha</i> (Thor.), 1877= <i>mandibulata</i> , sec. Simon. | Celebes. |

30. *lineata* (Thor.), 1890 [*Limoxera*]. Malaya, Tjibodas.
31. *listeri* (Gravely), 1921. Ceylon, Cochin.
32. *mackenziei* (Gravely), 1921. Calcutta.
33. *mandibulata* (Walck.), 1837 = *leptognatha* (Thor.) = *minatoria* (Sim.).
Ceylon, Mauritius &c.
34. *marginata* (Thor.), 1890 [*Limoxera*]. Burma, Sumatra.
35. *maxillosa* (Thor.), 1895. Burma, Java, Singapore.
36. *mertoni* (Str.), 1911. Aru and Kei Is.
37. *modesta* (Hirst), 1911. Seychelles.
38. *moulmeinensis* (Gravely), 1921. Moulmein.
39. *nepæformis* (Dol.), 1859. Buitenzorg.
40. *nigrigularis* (Sim.), 1897. Mahé.
41. *nigrita* (Strand). Japan.
42. *nitens* (Aud.), 1825. Aru and Kei Is.
43. *novea* (Sim.), 1901. Malaya.
44. *paradisea* (Poc.), 1900. Assam.
45. *parvula* (Thor.), 1891. Nicobars, Kamorta.
46. *planata* (Karsch), 1891. Ceylon.
47. *prædonia* (L. Koch), 1877. Japan.
48. *protensa* (Walck.), 1841. Mauritius.
49. *puella* (Thor.), 1895. Burma.
50. *pulchella* (Thor.), 1877. Burma, Celebes, Sumatra.
51. *rubriventris* (Dol.), 1857 = *lupata* (L. Koch), 1872. Kei, Cooktown.
52. *serra* (Dol.), 1856. Amboina.
53. *squamata* (Karsch), 1878. Japan.
54. *streichi* (Str.), 1907. Shanghai.
55. *sutherlandi* (Gravely), 1921. Cochin.
56. *tonkina* (Sim.), 1909. Tonkin.
57. *trichodes* (Thor.) 1878. Amboina.
58. *tridens* (Thor.). Burma.
59. *viridorufa* (Gravely), 1921. Cochin.

EUCTA (Sim.), 1881.

The following species of this genus are reported from the East :—

1. *anguilla* (Thor.), 1877. Celebes.
2. *caudicula* (Karsch), 1879 [*Eugnatha*]. Japan.
3. *isidis* (Sim.), 1880. Egypt.
4. *javana* (Thor.), 1890. Java.

E. javana (Thor.) is said to occur in India and Burma by Simon (1885, p. 450, and 1892, p. 722). According to Gravely (1921, p. 447) it appears to be the common Indian species. In my first paper (Ann. & Mag. Nat. Hist. ser. 9, vol. iv. no. 22, p. 232) I wrongly stated that Simon had reported *caudicula* (Karsch) from India. In the Simon Collection, Paris, specimens of *caudicula* are definitely reported from Yokohama by Simon, *isidis* from Malacca by Simon and also by him from Suez; but I found no specimens from India.

ORSINOME (Thor.), 1890.

The following species are known from our area :—

- | | |
|------------------------------------|--------------|
| 1. <i>armata</i> (Poc.), 1901. | Assam. |
| 2. <i>listeri</i> (Gravely), 1921. | Darjiling. |
| 3. <i>marmorea</i> (Poc.), 1901. | South India. |
| 4. <i>phrygiana</i> (Sim.), 1901. | Malaya. |
| 5. <i>vethi</i> (van Hass.), 1882. | Java. |

LEUCAUGE (White), 1841, including ARGYROEPEIRA (Em.), 1884, and CALLINETHIS (Thor.), 1890.

15. *Leucauge decorata* (Black.) [*Tetragnatha*].

Described by Blackwall originally from India (Ann. & Mag. Nat. Hist., July 1864, no. 79, pp. 44 & 45).

Locality. South Coorg (3000 ft.), on Charlotte Estate, Sidapur (December and January).

16. *Leucauge celebesiana* (Walck.) [*Tetragnatha*].

Described by Walckenaer, Ins. Apt. ii. p. 222 (1837).

In my first paper (1919, p. 233) I followed Pocock (1900, p. 216) in regarding these two names *decorata* and *celebesiana* as synonyms; but, as pointed out by Simon ('Voyage de M. Maindron,' 1906, pp. 282-283), and again more recently, with the aid of excellent distinctive figures, by Gravely ('Some Indian Spiders of the Subfamily Tetragnathinæ,' 1921, p. 453), *L. decorata* seems to be definitely Indian and quite distinct from *L. celebesiana* (Walck.), common throughout Malaysia to Australia. Unfortunately, Thorell (St. Rag. Mal. iv. p. 126, 1890) distinguished *decorata* as *celebesiana*—hence the confusion, for the true *celebesiana* is that of Walckenaer.

The Rev. O. P. Cambridge (Journ. Linn. Soc. vol. x. no. 46, p. 389, 1869) states that specimens from India sent by him to Blackwall were described by the latter as *decorata* (Ann. & Mag. Nat. Hist., July 1864), and that others from Bombay and since from Ceylon had reached him. He gives from them his descriptive figures of *decorata* on pl. xiii.

17. *Leucauge (Callinethis) elegans* (Thor.).

Described by Thorell, Ann. Mus. Gen. x. p. 416 (1877).

Argyropeira fastigata (Sim.).

Described by Simon, Ann. Soc. Ent. Fr. (5) vii. 1877, p. 79.

Locality. Charlotte Estate, Sidapur, South Coorg, at 3000 ft. (December, January, and also April).

The name given for this species is *fastigiata* (Hist. Nat. des Araig. i. p. 729, and again p. 732, where fig. 817 of *fastigiata* ♀ might be accepted as that of *elegans* (Thor.). Pocock, indeed (Faun. Brit. Ind., Arachnida, 1900, p. 216), makes his no. 221 *fastigata* (Sim.) synonymous with *elegans* (Thor.), but, on the other hand, Simon himself ("Arachnida of the 'Skeat' Expedition," P. Z. S. 1901, p. 57) regards *elegans* (Thor.) and his own *fastigata* (Sim.), 1877, as distinct species. The original spelling seems to be *fastigata*, for both Simon and Pocock use this form.

The following species I find recorded from the Oriental Region:—

1. *angustata* (Stol.), 1869 [*Nephila*] = *decorata* (Black.). Calcutta.
2. *annulipedella* (Strand), 1911. Aru and Kei Is.
3. *argentata* (Camb.), 1869. Ceylon.
4. *argentina* (van Hass.), 1882. Sumatra.
5. —, var. *nigroiceps* (Thor.), 1890. Penang.
6. *aurocincta* (Thor.), 1887. Celebes.
7. *beata* (Poc.), 1901. Assam.
8. *bengalensis* (Gravely), 1921. Calcutta.
9. *cavernicola* (Thor.), 1878 [*Meta*]. Amboina.
10. *celebesiana* (Walck.), 1837 [*Tetragnatha*], nec Thor. = *nigrotrivittata* (Dol.). Celebes, Malaya.
11. *coccinea* (Dol.), 1857 = *grata* (Guérin), 1830 [*Meta*]. Dutch New Guinea.
12. *cordivittata* (Strand), 1911. Aru and Kei Is.
13. *culta* (Camb.), 1869 = *scapitulata* (Sim.). Ceylon.
14. *decorata* (Black.), 1869 = *celebesiana* (Thor.) = *angustata* (Stol.). Ceylon, India.
15. *ditissima* (Thor.), 1887. Burma.
16. *elegans* (Thor.), 1877 [*Callinethis*] = *fastigata* (Sim.). Burma, Celebes.
17. *emertoni* (Thor.), 1890. Nias.
18. *fastigiata* (Sim.), 1877 [*Meta*] = *elegans* (Thor.) = *fastigata* (Poc.), 1900. Philippines, Malaya.
19. *fastuosa* (Thor.), 1877 = [*Meta*] *fastigiata* (Sim.). Celebes.
20. *fibulata* (Thor.), 1892. Singapore.
21. *geminea* (van Hass.), 1882. Burma, Sumatra, Malaya.
22. *granulata* (Walck.), 1837 = *orichalcea* (Dol.) = [*Meta*] *tuberculata* (Keys.). Celebes.
23. *hasseltii* (Thor.), 1890. Sumatra.
24. *lamperti* (Strand), 1907. Ceylon.
25. *leprosa* (Thor.), 1895. Burma.
26. *macrochæra*, var. *tenasserimensis* (Thor.), 1895. "
27. *nicobarica* (Thor.), 1891. "
28. *nigrotrivittata* (Dol.), 1859 = *celebesiana* (Walck.). Java, Celebes.
29. *papua* (Kulcz.). Sumatra.
30. *pumila* (Thor.), 1877. Celebes.
31. *pusilla* (Thor.), 1878. Celebes.
32. *quadrifasciata* (Thor.), 1890. Andamans, Amboina, Penang, Sumatra.

33. *rubrotrivittata* (Sim.), 1906, India.
 34. *scalaris* (Thor.), 1890. Sumatra.
 35. *searpustulata* (Sim.), 1906=*culta* (Camb.), 1809. India.
 36. *stictopyga* (Thor.), 1890. Sumatra.
 37. *striata* (Thor.), 1877=[*Meta*] *stellimicans* (Sim.)=*bigibba* (Thor.),
 1887, now type of new genus [*Tylorida*]. Burma, India.
 38. *superba* (Thor.), 1890. Nias.
 39. *tredecim-guttata* (Sim.), 1877=*argentina* (van Hass.). Philippines.
 40. *tessellata* (Thor.), 1887 [*Callinethis*]. Burma, Malaya.
 41. *tristicta* (Thor.), 1891 [*Meta*].
 42. *tuberculata* (Keys.)=*granulata* (Walck.).
 43. *ventralis* (Thor.), 1877. Burma, Celebes, Malaya.
 44. *vibrabunda* (Sim.), 1901. Java.
 45. *wokamara* (Strand), 1911. Aru and Kei Is.

PHONOGNATHA (Sim.), 1893.

In establishing his family Phonognatheæ, Simon (Hist. Nat. des Araig. i. pp. 746-749, 1893) included three new genera:—(1) *Phonognatha*, with *P.* [*Epeira*] *graeffi* (Keys.) as the type; (2) *Singotypa*, with *S.* [*Epeira* (*Meta*)] *melania* (L. Koch) as the type; and (3) *Deliochus*, with *D.* [*Epeira* (*Meta*)] *zelivera* (Keys.) as its type; all these hailing from New Holland or Tasmania or both.

P. graeffi (Keys.) has been reported from East Australia; *S. melania* (L. Koch) has been reported from Queensland; and *S. melanopygia* (L. Koch) has been reported from Queensland also.

When collecting I found several spiders with the fawn and blackish livery of a Phonognathid always within a curled-up withered leaf either at the centre of an orb-web or as a radius of it without any stabilimentum. The abdomen dorsally is grey-fawn with black bands both longitudinal and transverse.

From comparison with the specimens in the Simon Collection, Muséum d'Histoire Naturelle, Paris, my Coorg spiders are certainly not *zelivera* nor *melania* nor *graeffi*, but resemble the last most closely. This new species of *Phonognatha* from South Coorg is the first recorded from the Oriental Region, so far as I am aware. The description is as follows:—

18. *Phonognatha vicitra*, sp. n. (Figs. 1 & 2.)

♀ (in spirit), average 10 mm. long; seven examined (four mature).

Cephalothorax. Tan-coloured, deeper in tint round the eyes; cephalic area convex, raised and narrower than the thoracic, from which it is separated by a procurved shallow groove of deeper tint; fovea with radiating striæ.

Eyes. Medians as a trapeze, all four subequal, the anteriors

being slightly the larger ; laterals apart from the medians on each side subequal and almost touching.

Clypeus. Very narrow.

Abdomen. Cylindrical and blunt behind ; dorsally very variably marked in black or dark grey and fawn, in the best defined examples giving four pairs of unequal dark areas, the front and hind pairs uniting and all continuous with lateral black bands (as in fig. 1) ; ventrally the spinnerets are well separated off from the genital fold ; epigyne brownish, with two lighter dots.

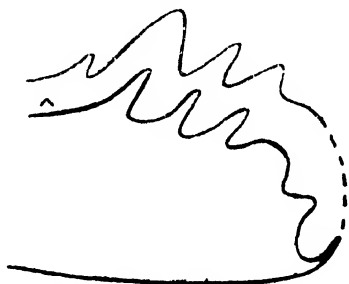
Sternum. Uniform tan ; bluntly seven-pointed, the back point median and sharper than the rest.

Chelicerae. Base stout, with marginal teeth as in fig. 2.

Fig. 1.



Fig. 2.



Phonognatha vicitra, sp. n.

Fig. 1.—Female ; dorsal view of abdomen. $\times 3$.

Fig. 2.—Female ; base of chelicera, showing margins. Greatly magnified.

Legs. Bare, sometimes uniform, but usually obscurely banded in darker rings, especially towards the extremities.

Several adults have the cephalothorax and bases of the legs irregularly spotted with minute pale dots. The specific name chosen is the Sanskrit word meaning "variegated."

Locality. Charlotte Estate, Sidapur, S. Coorg, at 3000 ft., December ; no cocoons got.

NEPHILA (Leach), 1815.

19. *Nephila maculata* (Fabr.).

Described by Fabricius, Ent. Syst. ii. p. 425 (1793) [*Aranea*].

Locality. Kandaloya Estate, Dolosbage, Ceylon.

In a collection of spiders recently received from this estate

was one of this species—the largest one sent,—which W. Russell Scott, Esq., in his covering letter, states was found devouring a bat caught in its web.

The following species have been reported from our area :—

- | | |
|--|-------------------------------|
| 1. <i>chrysogaster</i> (Camb.) = <i>maculata</i> (Fabr.). | Celebes. |
| 2. <i>clavata</i> (L. Koch), 1877. | Burma, India. |
| 3. <i>cruentata</i> (Fabr.). | World-wide in the Tropics. |
| 4. <i>fuscipes</i> (C. L. Koch) = <i>maculata</i> (Fabr.). | Celebes. |
| 5. <i>geniculata</i> (Walck.). | " |
| 6. <i>imperialis</i> (Dol.), 1857. | Burma, Malaya. |
| 7. <i>inaurata</i> (Walck.). | Celebes. |
| 8. <i>kuhlii</i> (Dol.), 1859. | Burma, India. |
| 9. <i>laurinae</i> (Thor.), 1881. | Ternate, Halmahera. |
| 10. <i>maculata</i> (Fabr.), 1793. | Celebes, Penang, Aru, Malaya. |
| 11. —, subsp. <i>jalorensis</i> (Sim.). | Malaya. |
| 12. <i>malabarensis</i> (Walck.), 1837. | Aru, Celebes, Penang. |
| 13. —, var. <i>papuanus</i> (Thor.), 1881. | Malaya. |
| 14. <i>obnubila</i> (Sim.), 1906. | Himalayas. |
| 15. <i>ornata</i> (Black.), 1864. | East Indies. |
| 16. <i>precuniosa</i> ? (L. Koch), 1872. | Philippines. |
| 17. <i>piepersii</i> (Thor.), 1877. | Celebes. |
| 18. <i>schmeltzi</i> (L. Koch), 1872. | Philippines. |
| 19. <i>venosa</i> (L. Koch), 1867. | Aru. |
| 20. <i>walckenaerii</i> (Dol.), 1857. | Celebes. |
| 21. <i>wallacei</i> (Thor.), 1877. | " |

ARGIOPE (Aud., 1825–27 ; Sav., 1827).

20. *Argiope taprobanica* (Thor.).

Described by Thorell, Ann. Mus. Gen. xxv. p. 163 (1887).
Locality. South Coorg, December, at 3000 ft. ; no cocoons.

The following species I find reported from the East generally :—

- | | |
|--|----------------------------|
| 1. <i>æmula</i> (Walck.), 1841 = <i>magnifica</i> (L. Koch). | Oriental. |
| 2. <i>ætherea</i> (Walck.), 1841. | Aru. |
| 3. —, var. <i>keyensis</i> (Strand), 1911. | Aru and Kei Is. |
| 4. <i>amana</i> (L. Koch), 1877. | Japan. |
| 5. <i>anasuja</i> (Thor.), 1887. | India. |
| 6. <i>arcuata</i> (Sim.), 1884. | Burma. |
| 7. <i>barbipoda</i> (Strand), 1911. | Aru and Kei Is. |
| 8. <i>catenulata</i> (Dol.), 1859. | Ceylon. |
| 9. <i>chloneis</i> (Thor.), 1877. | Celebes. |
| 10. <i>concinna</i> (Thor.), 1881. | Aru. |
| 11. <i>crenulata</i> (Dol.), 1857. | Amboina, Ternate, Celebes. |
| 12. <i>daboensis</i> (Strand), 1911. | Aru. |
| 13. <i>doleschalli</i> (Thor.), 1873. | " |
| 14. —, var. <i>bivittigera</i> (Strand), 1911. | " |
| 15. <i>halmaherensis</i> (Strand), 1907. | Celebes. |
| 16. <i>lobata</i> (Pallas), 1772. | India. |
| 17. <i>minuta</i> (Karsch), 1878. | Japan |

- | | |
|---|--------------------------|
| 18. <i>niassensis</i> (Strand), 1907. | Aru. |
| 19. <i>picta</i> (L. Koch), 1871. | " |
| 20. <i>plagiata</i> (Karsch), 1891. | Minikoy. |
| 21. <i>pulchella</i> (Thor.), 1881. | Andamans, Burma, Malaya. |
| 22. <i>stellata</i> (Stoll), 1869= <i>catenulata</i> ? (Dol.). | Sunderbunds. |
| 23. <i>succincta</i> (L. Koch), 1871. | Borneo, Sarawak. |
| 24. <i>taprobanica</i> (Thor.), 1887. | Ceylon, India. |
| 25. <i>trifasciata</i> (Dol.), 1857. | Celebes. |
| 26. <i>trivittata</i> (Karsch), 1891= <i>æmula</i> ? (Walck.). | Ceylon. |
| 27. <i>uljirica</i> (Strand), 1911. | Aru. |
| 28. <i>undulata</i> (Thor.), 1887. | Burma. |
| 29. <i>verecunda</i> (Thor.), 1878. | Amboina, Halmahera. |
| 30. <i>versicolor</i> (Dol.), 1859= <i>taprobanica</i> ? (Thor.). | Ceylon. |

To the above list it seems desirable to add another:—

21. *Argiope lalita*, sp. n. (Figs. 3-7.)

♀ (in spirit) 10 mm. long; two adults examined.

Cephalothorax. Cephalic part well marked off by being covered with short, dense, light blue hairs, as are also the sides of the thoracic area, which otherwise is dark brown and much wider than the cephalic; fovea longitudinal, but faintly indicated.

Eyes. Back line distinctly procurved and subequal; front line smaller but also subequal and recurved. Median ocular area roughly forms a square, laterals almost in contact with each other but not raised highly on prominences (see fig. 3).

Clypeus. Very narrow, less than ocular area in width.

Abdomen. About 7 mm. long by 5 mm. at widest part; oval, but pointed behind; dorsally on a dark ground there is a very well-marked series of light blue or sometimes pearly-white spots of varying size and shape (see fig. 4); two small median slender prominences, with two still smaller ones, one on each side of the former, mark the tops of the upper four white spots; ventrally the median dark area between the spinnerets and the epigyne has eight minute paired dots bordered in white, and is bounded laterally and terminally by broad white lines. The epigastric area seems to contain between the epigastric plates a median opening, the nature of which needs further elucidation.

Sternum. Black, with a faint median yellow line.

Chelicere. Normal, much larger than the clypeus.

Legs. Normal, femora dark, tibiae banded fawn and black, tarsi and metatarsi fawn.

The cocoons measure 10 mm. at greatest length and 6 mm. at greatest breadth. They have a very characteristic shape (see fig. 5), and are suspended from the top line of the web

by strong tendrils of silk arising from the open end of the cocoon.

♂ (in spirit) 1 mm. long ; two examined.

Cephalothorax. Black, relatively much larger than in ♀ as compared with the abdomen ; convex, narrowed in front.

Eyes. Front row slightly recurved ; back row distinctly procurved ; laterals touching, but front ones much smaller

Fig. 3.



Fig. 4.



Fig. 6.

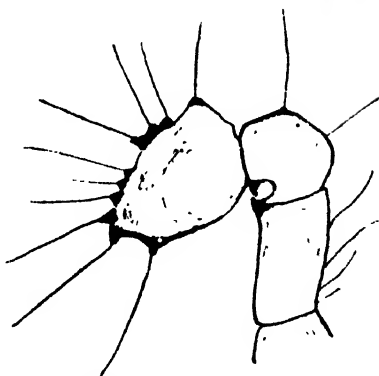


Fig. 5.



Argiope lalita, sp. n.

Fig. 3.—Female; eye arrangement. Enlarged.

Fig. 4.—Female; abdomen, seen dorsally. × 3.

Fig. 5.—Cocoon. × 2.

Fig. 6.—Male; palp. Greatly magnified.

than the posterior ; medians form a square, the front pair project in front over the clypeus.

Clypeus. Narrow, but slightly wider than diameter of the front median eyes.

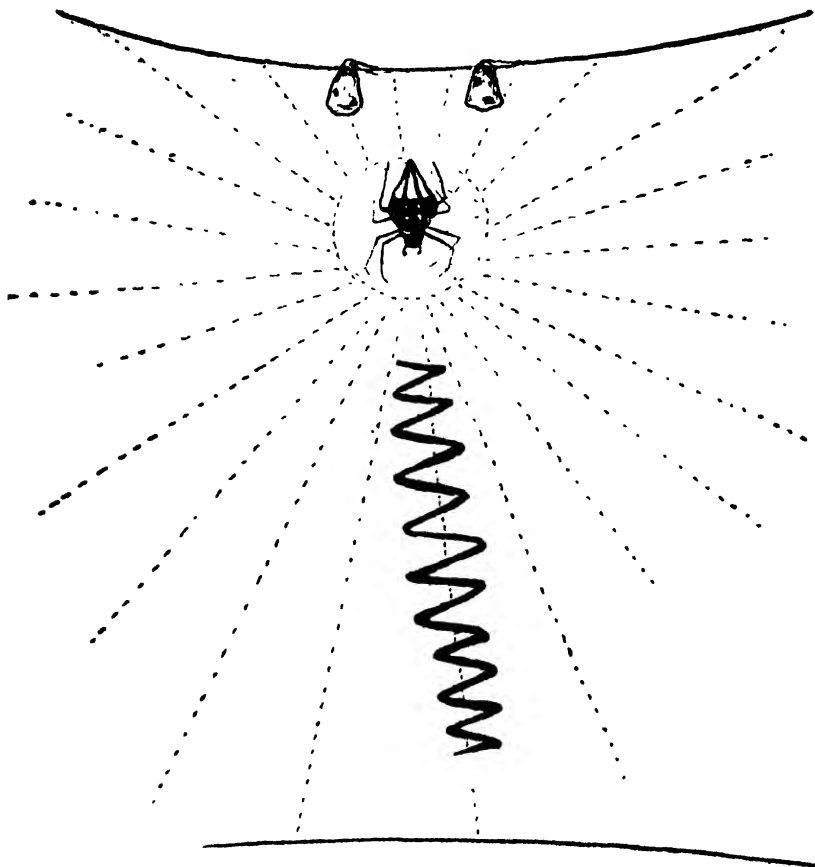
Abdomen. Dorsally uniform black, oval, with four pairs of distinct sigillae ; ventrally black, and so also laterally ; small white hairs scattered over the surface.

Sternum. Black, convex, heart-shaped, with scattered long white hairs and blunt median back-tip.

Chelicerae. Black, very strong.

Legs. All black, with white hairs generally, but specially on the femora.

Fig. 7.



Argiope lalita, sp. n.

Female on web, showing roughly two cocoons, the central disc on which the spider rests, and the zigzag stabilimentum.

Palp. All black; very minute (see fig. 6); tarsus with one distinct hook; bulb with long hairs arising from distinct bases that are small tubercles.

Since the eyes are distinctly arranged in three groups, the four medians as a square or trapeze, with the lateral pair on each side, this new species, according to Simon (Hist. Nat. des Araig. i. p. 760), comes under the subfamily Argiopinae, within which it belongs to the genus *Argiope*, from its eye-arrangement, the minute size of the male, and the nature of the web with its stabilimentum (see fig. 7). The female livery of velvety blue, white, and black is unlike that of any other spider known to me. The cocoons, so far as I am aware, are also of unique shape.

The spiders were found on a vertical web made on a rose bush in the garden. The female spider rests head downwards on a white circular mass of silk, about $\frac{3}{4}$ inch diameter, towards the upper end of the web. Below this mass is a single vertical white zigzag band of silk, some 2 inches long, after the usual Argiopid type of stabilimentum. The greenish cocoons, some $\frac{1}{2}$ inch long, were suspended above the spider from the top edge of the web, which consists of a specially strong thread. The small male keeps at the back of the white disc behind his much larger consort.

The tiny male is minute and all black, while the female is one of the loveliest spiders I have seen.

Behind the web proper is an irregular arrangement of threads, the "barrier-web" of Comstock ('The Spider Book,' p. 433), dotted here and there with white flecks after the fashion of a Gasteracanthid. The type of web and position of the spider is similar to Comstock's fig. 448 for *Metargiope trifasciata*, which, however, has no stabilimentum.

Locality. Charlotte Estate, Sidapur, S. Coorg (December).

The specific name *lalita* is the Sanskrit word meaning "lovely."

CYRTOPHORA (Sim.), 1864.

Species of this genus from the East include :—

- | | |
|--|--------------------|
| 1. <i>acrobatis</i> (Thor.), 1895. | Burma. |
| 2. <i>cicatrosa</i> (Stol.), 1809 = <i>Epeira salebrosa</i> (Thor.), 1878 = <i>Euetria salebrosa</i> . | Ceylon, India. |
| 3. <i>citricola</i> (Forsk.), 1775. | Tropics generally. |
| 4. <i>evanthematica</i> (Dol.), 1859. | Burma, Ceylon. |
| 5. <i>moluccensis</i> (Dol.), 1857 = [<i>Epeira</i> and <i>Euetria</i>]. | Celebes. |
| 6. <i>perfissa</i> (Thor.), 1895. | Burma. |
| 7. <i>unicolor</i> (Dol.), 1857 = [<i>Epeira</i>] <i>stigmatisata</i> (Karsch), 1878 = [<i>Epeira</i>] <i>serrata</i> (Thor.), 1890. | Malaya, Burma. |

To the above may be added the species no. 44 in my first paper, in which it was described from Coonoor, Nilgiris (April), at 6000 ft.

22. *Cyrtophora ksudra*, sp. n.

♀ (in spirit) 4 mm. long; six examined.

Cephalothorax. Uniform dark brown, cephalic part raised, with side-grooves; fovea longitudinal.

Eyes. Front line slightly recurved, back line procurved; front medians smaller and closer together than the posterior medians, which are much larger and quite apart; laterals separate from the median trapeze and touching each other—they are smaller than the medians.

Clypeus. As broad as the ocular area.

Abdomen. Dorsally an irregular oval, black, and may project over and beyond the spinnerets below; laterally black, with towards the hind end two irregular white broken lines reaching up to the dorsal median line at times, each line formed by a number of white spots, elsewhere a few smaller scattered white dots; ventrally uniform black; spinnerets terminal brown; epigyne large, arched, and dark red.

Sternum. Uniform dark brown, convex, roughly triangular.

Chelicerae. Straight, strong.

Legs. Coxæ yellow; femora olive, banded in black; tibiae dark olive.

♂. Two examined, very like female in size, shape, and colouring; unfortunately both immature.

The web made by both sexes is similar to that of *Cyrtophora cicatrosa* (Stol.), the male making a much less perfect structure. No cocoons obtained. Diameter of web about 12 inches.

Locality. Charlotte Estate, Sidapur, South Coorg (December), at 3000 ft.

The specific name chosen is a Sanskrit word meaning "small."

It should be noted that we place this spider as a *Cyrtophora*, following Simon, Hist. Nat. des Araig. i. p. 773, where he describes the *Cyrtophora* as not being distinct from *Araneus* or *Argiope* in any very important or very constant character, save in the arrangement and shape of their webs. In this case the eye-arrangement is nearer the Argiopid type, with the back line distinctly procurved, a state of affairs which for *Cyrtophora* Simon (p. 770) categorically denies.

CYCLOSA (Menge), 1886.

23. *Cyclosa insulana* (Costa).

Described by Costa, Cenni Zool. p. 65 (1834).

Is the commonest species, and is very variable.

Locality. S. Coorg (December); no cocoons seen.

24. *Cyclosa bifida* (Dol.).

Described by Doleschall, Verh. Nat. Vereen. Ned. Indie, v. p. 38 (1859).

Very slender, long, black spiders, with silvery spots on the abdomen; the web has no stabilimentum.

Locality. S. Coorg, about 3000 ft.

This species is reported by Simon from Malaya and Tonkin, but his collection contains specimens also from Kandy and Galle, Ceylon. A closely allied species seems to be *C. carbonaria* (Sim.) from Yokohama.

25. *Cyclosa mulmeinensis* (Thorell).

Described by Thorell, Ann. Mus. Gen. xxv. p. 221 (1887)

With cocoon-mass as a diameter of the orb-web.

Locality. S. Coorg, about 3000 ft.; already reported from India and Burma.

26. *Cyclosa micula* (Thorell).

Described by Thorell.

On orb-webs, with stabilimentum as radius only. Two yellow-brown cocoons were attached to this radius. One cocoon held forty eggs. Webs were along a hedge of whin-bushes.

Locality. Ootacamund, Nilgiris, at 7200 ft.

This species has been previously reported from Singapore; Simon has it also from Trichinopoly, S. India.

The following species have been reported from our area:—

- | | |
|---|-----------------|
| 1. <i>albisternis</i> (Sim.), 1887. | Andamans. |
| 2. <i>argenteoalba</i> (Bos. & St.), 1906 | Japan. |
| 3. <i>atrata</i> (Bos. & St.), 1906. | " |
| 4. <i>bifida</i> (Dol.), 1859. | Amboina, Burma. |
| 5. — <i>macrura</i> (Thorell), 1877. | Malaya. |
| 6. <i>camelodes</i> (Thorell), 1878. | Amboina. |
| 7. <i>carbonaria</i> (Sim.). | Japan. |
| 8. <i>confraga</i> (Thorell), 1892. | Singapore. |
| 9. <i>confusa</i> (Bos. & St.), 1906. | Japan. |
| 10. <i>culigata</i> (Thorell), 1889. | Sumatra. |
| 11. <i>fissicauda</i> (Sim.), 1889. | Himalayas. |
| 12. <i>hybophora</i> (Thorell), 1887. | Burma. |
| 13. <i>insulana</i> (Costa), 1834 = [<i>Epeira</i>] <i>anseripes</i> (Walck.), 1841 = [<i>Epeira</i>] <i>trituberculata</i> (Lac.) = [<i>Cyclosa</i>] <i>melanura</i> (Sim.), 1877 = [<i>Cyrtophora</i>] <i>interalbicans</i> (Bos.). | India, Malaya. |
| 14. <i>japonica</i> (Bos. & St.), 1906. | Japan. |
| 15. <i>laticauda</i> (Bos. & St.), 1906. | " |
| 16. <i>longicauda</i> (Thorell), 1877. | Celebes. |

17. *melanura* (Sim.), 1877=*insulana*.
18. *micula* (Thor.), 1892. Singapore.
19. *monticola* (Bös. & St.), 1906. Japan.
20. *mulmeinensis* (Thor.), 1887. Burma, India.
21. *oatesii* (Thor.), 1892. Andamans, India.
22. *octotuberculata* (Karsch), 1878. Japan.
23. *paupercula* (Sim.), 1893. Sarawak.
24. *pellax* (Thor.), 1892. Singapore.
25. *propinqua* (Sim.), 1882=*insulana* (Costa). Arabia.
26. *psylla* (Thor.), 1887. Burma.
27. *quinque-guttata* (Thor.), 1881. "
28. *sedeculata* (Karsch), 1878. Japan.
29. *sierræ* (Sim.), 1870=[*Epeira*] *incongrua* (Camb.), 1872=*caudata* (L. K.), 1876. Japan.
30. *spirifera* (Sim.), 1889. Himalayas.
31. *tardipes* (Thor.), 1895. Burma, Singapore.
32. *tuberascens* (Sim.), 1906. Himalayas.
33. *turbinata* (Walck.)=[*Epeira*] *caudata* (Hentz.)=[*Epeira*] *strangulata* (L. Koch). Malaya, Aru.
34. *vallata* (Bös. & St.), 1906. Japan.

XXII.—*A new Genus of Acrididæ (Orthoptera) from Obock.*
By Dr. M. SALFI (Naples).

[Plate VIII.]

THIS paper contains a description of a new genus and species of Acrididæ from Obock (French Somaliland), based on material of the Paris Museum.

My most sincere thanks are due to Dr. B. P. Uvarov, through whom I have received the material, and specially for the very valuable suggestions and precious instructions which I received from him.

PLATYPTERNELLA, gen. nov.

Body elongate, compressed laterally. Head globous, relatively short, feebly prominent, narrowed upwards. Face convex. Frontal ridge broad and scarcely sulcate, with lateral margins practically parallel, feebly narrowed upwards. Fastigium of vertex triangular, with broad and obtuse margins. Longitudinal keel of vertex scarcely raised, linear. Foveolæ of vertex less than twice as long as broad, feebly curved, trapezoidal in shape, with very distinct curved margins. Antennæ slender, not longer than twice the length of head and pronotum; basal third with feebly dilated articles.

Pronotum slightly constricted in the middle; anterior margin straight; hind margin obtuse triangular. Median

keel smooth, feebly raised; lateral keels well developed, slightly convergent between the first sulcus of the prozona and the typical sulcus, considerably divergent in metazona. Typical sulcus scarcely curved behind the middle. Lateral lobes as long as high, subtrapezoidal in shape; anterior margin feebly concave; posterior margin feebly sinuate, oblique; lower margin oblique. Anterior angle obtuse, almost right; posterior angle broad, rounded.

Mesosternal lobes with interior margin rounded and lower margin feebly concave, separated by a relatively narrow interspace. Mesosternal lobes connected along the median line.

Elytra perfectly developed, narrow, a little longer than abdomen, with false vein in the discoidal and interulnar area; apex rounded. Wings a little shorter than elytra.

Hind femora relatively short and thick, with filiform part scarcely developed. Anterior and median tibiæ spinulose at the lower margins. Hind tibiæ as long as hind femora, not incrassate apically.

General coloration yellowish with dark brown spots. Dorsal median fascia of the ground-colour extending from vertex through the disc of pronotum to the anal area of elytra, laterally limited by two dark brown fasciæ. Hind femora with genicular and three irregular black-brown spots at the inner side.

Genotype: *Platypternella pictifemur*, sp. n.

This genus is closely related to *Platypterna*, Fieber, but differs from it in several important characters, as follows:—The shape and dimensions of temporal foveolæ, which in the new genus are trapezoidal, almost subquadrate, while in *Platypterna* they are elongated and slightly narrowed; the structure of the pronotum, which in the new genus is feebly but distinctly constricted in the middle, and this never occurs in *Platypterna*; the fasciation of the hind femora at the inner side, which in *Platypterna* is always without any pattern.

Platypternella pictifemur, sp. n.

Morphological characters.—♀. Head relatively short, slightly globous, feebly prominent, and narrowed upwards. Antennæ of twenty-six articles, scarcely longer than twice the length of the head and pronotum, with the basal articles depressed; third article elongate, subtrapezoidal in shape; fourth feebly transverse, about half again as broad as long;

fifth half again as long as the fourth ; sixth very prolonged, twice as long as fourth ; seventh subcylindrical, very long, narrowed, with a transversal adventive sulcus ; eighth, ninth, tenth, and eleventh feebly depressed, twelfth and the following relatively long, cylindrical, subequal in length. The three apical articles very short, almost submoniliform in shape. Vertex subtriangular, rounded, feebly convex, with a smooth, feebly raised, longitudinal keel. Fastigium of vertex seen in profile triangular-obtuse, not longer than broad, limited above laterally by broad rounded margins, posteriorly obliterated. Temporal foveolæ less than twice as long as high, feebly curved, trapezoidal in shape, with very evident and curved margins, anteriorly feebly but posteriorly distinctly impressed. Face convex, narrowed upwards ; lateral keel slightly curved, sharp, moderately raised. Frontal ridge feebly impressed, strongly convex, with well-developed margins which are practically parallel, narrowed upwards, slightly divergent towards the clypeus. Transverse sulci of the face curved, very feebly impressed. Ocelli very small. Eyes globous, feebly prominent, subtriangular, with the apex narrowed ; their longest diameter less than twice the shortest one. Sub-ocular sulcus well developed, practically straight.

Pronotum slightly constricted in the middle ; anterior margin practically straight ; hind margin obtuse-triangular. Disc with lateral keels well developed, almost parallel, feebly curved in prozona, distinctly divergent in metazona. First and second pronotal sulci not reaching the median keel. Median keel slightly raised. Typical sulcus sharp, scarcely curved. Lateral lobes about as long as high. Anterior margin feebly concave ; posterior margin oblique, practically straight, feebly sinuate ; lower margin oblique, with an obtuse angle about the middle. Anterior angle obtuse, almost right ; hind angle rounded, broad. In the lateral lobes the paramarginal sulcus is very feebly impressed and irregular ; the first pronotal sulcus very short ; the second well developed, feebly sinuate, almost reaching the lower margin. Typical sulcus distinct above, broad and very feebly impressed below.

Mesosternal lobes rounded, somewhat broader than long, narrowed, with the interspace constricted in the middle, where it is less than half as broad as one of the lobes. Metasternal lobes connected along the median line, with the hind lower angle practically right.

Elytra perfectly developed, scarcely extending beyond the end of the abdomen. Scapular area with a longitudinal

incrassation in its basal third. Radial veins connected and parallel in about the basal third, divergent afterwards. Discoidal area with a regular moderately thick false vein and regular moderately elongate cells. Ulnar veins divergent. Interulnar area with regular cells like those of discoidal area. Anal vein thick. Anal area with irregular cells, reticulated.

Wings hyalinous, perfectly developed, slightly shorter than elytra.

Anterior and median femora slightly incrassate apically. Anterior and median tibiæ with small spines at the lower margins. Hind femora feebly incrassate, with the filiform part very short. Hind tibiæ not incrassate apically, with the pair of external apical spurs a fourth shorter in length than interior pair. Tarsi with arolia distinctly shorter than claws.

Valvæ of the ovipositor short; anal plate triangular, apically obtuse, with curved margins; subgenital plate with hind margin practically straight, feebly emarginate in the middle, and with two small acute projections laterally. Cerci conical, very short.

Coloration (the two specimens examined seem to have been preserved in alcohol before desiccation).—General coloration yellowish, with dark brown spots and fasciæ. Head with two dark brown fasciæ, para- and postocular originate in the fastigium of vertex. Disc of pronotum with two lateral fasciæ which are the continuation of those of head and are prolonged in the interulnar area of elytra. These two lateral fasciæ delimit a median fascia of the same ground-colour which extends from the vertex to the extremity of the anal area of elytra. Lateral lobes with a median brown-reddish spot in the type, unicolorous in the other specimen. Pleuræ brown, reddish-spotted. Abdominal tergite with reddish-brown transverse fasciæ. Hind femora unicolorous outwards, but feebly spotted apically; inner side with a genicular and three large, irregular, black-brownish spots.

Described from two females from Obock (French Somaliland).

The dimensions of the two specimens are as follows:—

	♀ (type). mm.	♀ (paratype). mm.
Length of the body	32	31.5
" " head	4	3.7
" " pronotum	5.5	5.8
" " elytra	27	27
" " hind femora ..	14	14

EXPLANATION OF PLATE VIII.

Platypternella pictifemur, sp. n. (♀).*Fig. 1.* Side view of head and pronotum.*Fig. 2.* Dorsal view of head and pronotum.*Fig. 3.* Meso- and metasternum.*Fig. 4.* Hind femur from within.*Fig. 5.* Right antenna from above.*Fig. 6.* Fastigium of vertex and left temporal foveola.*Fig. 7.* Ventral view of abdominal end (subgenital lamina and valvæ o ovipositor).XXIII.—*The Exploratory Voyages of the 'Florence Brierley.'*
Notes on the Fish recorded. By C. F. HICKLING, M.A.,
Fisheries Laboratory, Lowestoft.

AN account of the exploratory voyages of the steam-trawler 'Florence Brierley' of Fleetwood, in April and May 1927, has been published elsewhere (1), where the fishing operations were dealt with especially from the standpoint of the hake-fisheries.

It may be repeated here that, during these voyages, 118 hauls were made in the course of 31 days' fishing-time, and that the depths worked ranged from 89 to 560 fathoms.

Notes were kept on the species of fish occurring in the hauls, and a total number of 61 species was recorded. This list does not claim to be exhaustive, and many of the species are recorded from single specimens or very few specimens. These species are marked with an asterisk in Table I. (pp. 199 & 200). Four species are recorded from stomach-contents only—namely, the mackerel (*Scomber scomber*), the greater sand-eel (*Ammodytes lanceolatus*), *Scopelus punctatus*, and *Maurolicus pennanti*. *Scopelus* and *Maurolicus*, which are very small bathypelagic fishes, are too small to be caught in the trawl.

Three regions were investigated—namely, the Faroe-Shetland Channel, from the Wyville Thompson Ridge eastward, the Scottish Atlantic Slope, from the Wyville Thompson Ridge westward and southward to Tory Island, and the Rockall Bank.

In the Faroe-Shetland Channel 27 hauls were made, at depths between 89 and 560 fathoms; on the Scottish Atlantic Slope 86 hauls were made, at depths between 118 and 520

fathoms; and on the tail of Rockall Bank 5 hauls were made, at depths between 132 and 285 fathoms.

In Table I. the recorded species are set out, and a cross (×) indicates in which of the three regions they were found. No attempt at quantitative observations on the occurrence of the species was possible.

On comparing the list of fish from the Faroe-Shetland Channel with the list of fish from the Atlantic Slope, it will be seen that eighteen species are common to both regions. Of the remaining ten species found in the Faroe-Shetland Channel, but not on the Atlantic Slope, the mackerel, haddock, cod, *Gadus esmarkii*, *Anmodytes lanceolatus*, and the herring are well known on the continental shelf to the west of the British Isles, and their non-appearance in the hauls made by the 'Florence Brierley' in the latter area is probably due to the fact that the shallowest water there worked was 118 fathoms.

The remaining four species, found in the Faroe-Shetland Channel but not on the Scottish Atlantic Slope, are more interesting. *Sebastes norvegicus* is a typically northern fish, which lives pelagically over the coast-banks and great deeps of the Norwegian Sea, and has been caught there on floating long-lines by Hjort (3).

Raia hyperborea and *Somniosus microcephalus* are defined by Hjort (3) as being among the principal cold-water fish of the deeps of the Norwegian Sea, and the genus *Lycodes* is also characteristic of the Norwegian Sea, though *L. esmarkii* itself has been recorded by Goode and Bean (4) from the American Atlantic continental slope, and is defined by Jensen (5) as a "decidedly Atlantic form," in contrast with other species which he defines as Arctic forms.

A single specimen of *Lycodes esmarkii* and two small specimens of *Raia hyperborea* were the total catch resulting from a tow of 1½ hours with a full-sized Vigneron-Dahl trawl, at a depth of 560 fathoms, in the Faroe-Shetland Channel. At a depth of 520 fathoms, on the western side of the Wyville Thompson Ridge, a haul of similar length yielded quite a fair quantity of fish, including *Alepocephalus*, *Mora*, *Chimæra*, etc. Hjort (3) remarks on this poverty of life in the deeps of the Norwegian Sea and on the relative abundance of fish at considerable depths on the Atlantic Slope.

In the Faroe-Shetland Channel only 28 species of fish were noted in the catches, whereas on the Scottish Atlantic Slope a much greater number—49 species—was noted. It is true that one would expect a greater number of species in a series of eighty-six hauls than in a series of twenty-seven

hauls, since the greater number of hauls would tend to include a greater number of the rarer species. But fish were very scarce in quantity as well as in variety, and most of the hauls made in the Faroe-Shetland Channel yielded only a couple of baskets of fish for hauls of two hours' duration. Thus it appears, from our experience, that the poverty of fish-life in the depths of the Norwegian Sea seems also to be a feature of the higher slopes of the Continental Shelf in the Faroe-Shetland Channel, at least at the time of the exploratory voyages.

Referring again to Table I., it is clear that the fish-fauna of the lower slopes of Rockall Bank very closely resembles that of the Scottish Atlantic Slope at similar depths, allowing, of course, for the very small number of hauls made and for the fact that no deeper water than 285 fathoms was worked. Even the bream (*Pagellus centrodontus*), which Hjort (3) cites as a typically southern fish, was found on the deeper slopes of Rockall Bank, though the hake, which is the characteristic fish of the Scottish Atlantic Slope, was entirely absent.

It is therefore interesting to note that commercial fishing-vessels, which work the shallower portions of the Bank within the 100-fathom line, land catches in which northern species predominate. For example, in 1925 the statistics (6) show that 26 % by weight of the fish landed from Rockall were haddocks, 15 % cod, 15 % ling, 12 % tusk, and 12 % halibut. Cod, halibut, and tusk are defined as "northern fish" by Hjort (3), as are haddock, cod, ling, and tusk by Schmidt (2).

Nansen (7) found that the plateau of Rockall Bank carried comparatively cold water (8°·2 C.) as compared with 9° C. in the surrounding waters at a similar depth. Similar temperature conditions were observed by the 'Florence Brierley' (1), when colder water of 8°·2 C. was found as deep as 200 fathoms on the south-eastern slopes of the Bank.

It is therefore significant that we found a typically northern fish—*Sebastes norvegicus*—in our hauls here. This species was also met with in the Faroe-Shetland Channel, but not on the Scottish Atlantic Slope. The evidence of the catches of commercial fishing-vessels also points to a fish-fauna of a distinctly northern character on the plateau of Rockall Bank, which is probably associated with the colder water there; whereas, on the deeper slopes of the Bank, where the water is warmer, the fish-fauna, as deduced from the hauls of the 'Florence Brierley,' more closely resembles that of the Scottish Atlantic Slope.

TABLE I.

Species.	27 hauls in Faroe-Shetland Channel.	86 hauls on Scottish Atlantic Slope.	5 hauls on Rockall Bank.
1. <i>Hexanchus griseus</i> , Rafinesque	x	x	
2. <i>Galeus vulgaris</i> , Fleming	x	x	x
3. <i>Pristiurus melanostomus</i> , Rafinesque ..	..	x	x
*4. <i>Centroscymnus caelolepis</i> , Bocage et Capello ..	..	x	
*5. <i>Sommiosus microcephalus</i> (Schneider), Goode & Bean	x		
6. <i>Acanthias vulgaris</i> , Risso	x	x	
7. <i>Centrophorus squamosus</i> , Gmelin .....	..	x	x
8. — <i>granulosus</i> , Muller & Henle .....	..	x	
9. <i>Scymnodon ringens</i> , Bocage et Capello ..	..	x	
10. <i>Spinax niger</i> , Cloquet	x	x	
11. <i>Scymnorhinus lichia</i> , Bonaparte .....	..	x	
*12. <i>Raja batia</i> , Linnæus	x	x	x
*13. — <i>fullonica</i> , Linnæus	x	x	x
*14. — <i>oxyrhyncha</i> , Linnæus .....	..	x	
*15. — <i>hyperborea</i> , Collett	x		
16. <i>Chimæra monstrosa</i> , Linnæus	x	x	x
*17. — <i>mirabilis</i> , Collett .....	..	x	
18. <i>Epigonus telescopus</i> , Risso .....	..	x	
19. <i>Pagellus centrodontus</i> , de la Roche .....	..	x	x
20. <i>Sebastes norvegicus</i> , Ascanius	x	..	x
21. <i>Scorpena dactyloptera</i> , de la Roche	x	x	x
*22. — <i>cristulata</i> , Goode & Bean .....	..	x	
23. <i>Aphanopus carbo</i> , Lowe .....	..	x	
*24. <i>Centrolophus niger</i> , Gmelin .....	..	x	
*25. <i>Anarrhichas lupus</i> , Linnæus .....	..	..	x
*26. <i>Lycodes esmarkii</i> , Collett	x		
†27. <i>Scomber scomber</i> Linnæus	x		
28. <i>Lophius piscatorius</i> , Linnæus	x	x	
29. <i>Trigla gurnardus</i> , Linnæus	x	x	x
30. — <i>lyra</i> , Linnæus .....	..	x	
*31. — <i>hirundo</i> , Bloch .....	..	x	
32. <i>Gadus aeglefinus</i> , Linnæus	x	..	x
33. — <i>morrhua</i> , Linnæus	x		
34. — <i>esmarkii</i> , Nilsson	x		
35. — <i>virens</i> , Linnæus	x	x	
36. — <i>poutassou</i> , Risso	x	x	x
37. <i>Gadiculus argenteus</i> , Guichenot .....	..	x	x
*38. <i>Motella tricarvata</i> , Nilsson .....	..	x	

* Single specimens, or very rare.

† Occurring in stomach-contents only.

TABLE I. (*continued*).

Species.	27 hauls in Faroe-Shetland Channel.	86 hauls on Scottish Atlantic Slope.	5 hauls on Rockall Bank.
39. <i>Mora mediterranea</i> , Risso	×	
40. <i>Merluccius vulgaris</i> , Fleming	×	×	
41. <i>Phycis blennioides</i> , Brunn.	×	×	
42. <i>Molva vulgaris</i> , Fleming	×	×	×
43. <i>Molva byrkelange</i> , Walb. { See text	×	×
44. — <i>elongata</i> , Risso	×	×
45. <i>Haloporphyrus eques</i> , Günther	×	
46. <i>Brosomus brosme</i> , Ascanius	×	×	×
†47. <i>Ammodytes lanceolatus</i> , Lesauvage	×	×	
48. <i>Malacocephalus laevis</i> , Lowe	×	×	×
49. <i>Trachyrhynchus trachyrhynchus</i> , Risso	×	
50. <i>Cælorhynchus cælorhynchus</i> , Risso	×	
51. <i>Coryphænoides rupestris</i> , Gunner	×	
52. <i>Hippoglossus vulgaris</i> , Fleming	×	
53. <i>Arnoglossus laterna</i> , Walb.	×	×
54. <i>Pleuronectes cynoglossus</i> , Linnæus	×	×
*55. <i>Rhombus maximus</i> , Linnæus	×	
56. <i>Argentina silus</i> , Ascanius	×	×	×
57. — <i>sphyræna</i> , Linnæus	×	×
†58. <i>Scopelus punctatus</i> , Rafinesque	×	
†59. <i>Maurolicus pennanti</i> , Walbaum	×	
60. <i>Clupea harengus</i> , Linnæus	×		
61. <i>Alepocephalus giardi</i> , Koehler	×	

NOTES ON THE RANGE IN DEPTH OF THE PRINCIPAL SPECIES.

Of the sixty-one species set forth in Table I. thirty-six occurred sufficiently regularly and abundantly to warrant some conclusions as to the range of depth of the hauls in which they were taken.

A note is necessary, however, on the procedure adopted in assuming a figure to represent the depth of any given haul. As is well known, the sea-bottom beyond the 100-fathom line is often extremely uneven, and during any one haul the net may traverse widely varying depths. But the only figure one is strictly entitled to assume, is the mean depth of shooting

* Single specimens, or very rare.

† Occurring in stomach-contents only.

TABLE II.—Range in Depth (Fathoms) of principal Species.

Species.	90-100	100-120	120-140	140-160	160-180	180-200	200-220	220-240	240-260	260-280	280-300	300-320	320-340	340-360	360-380	380-400	400-500	500-520
1. Gurnards (<i>Trigla lyra</i> and <i>T. gurnardus</i>).....	x	x															x	
2. Cod (<i>Gadus morhua</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3. Blackjack (<i>Gadus virens</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4. Tusk (<i>Bremonus brosme</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
5. Ling (<i>Molva vulgaris</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6. Spur-dog (<i>Acanthius vulgaris</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7. Hake (<i>Merluccius vulgaris</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
8. Herring (<i>Clupea harengus</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
9. Norway haddock (<i>Sebastes norvegicus</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10. Haddock (<i>Gadus aeglefinus</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
11. <i>Chimera monstrosa</i> and <i>C. mirabilis</i> *.....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
12. <i>Melanocephalus levis</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
13. Soldier (<i>Scorpena dactyloptera</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
14. Blue whiting (<i>Gadus pontassou</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
15. <i>Pseudoternus melanostomus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16. Torsk (<i>Gadus vulgaris</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
17. Fortbeard (<i>Phycis blennioideus</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
18. Mottled shark (<i>Spinax niger</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
19. Megrim (<i>Arroglossus laterna</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
20. Bream (<i>Pagellus centrodontus</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
21. Smelt (<i>Argentina silus</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
22. Monk (<i>Lophius piscatorius</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
23. Deep-sea ling (<i>Molva byrkclange</i> and <i>M. elongata</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
24. Crocodile (<i>Aphanopus carbo</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
25. <i>Seymourinus ichia</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
26. <i>Centrophorus squamosus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
27. <i>Epygonus telescopus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
28. <i>Centrophorus granulosus</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
29. <i>Seymourinus ringens</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
30. Halibut (<i>Hippoglossus vulgaris</i>).....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
31. <i>Coryphenoides rupestris</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
32. <i>Mora mediterranea</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
33. <i>Alepocephalus giardi</i>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

* See text, p. 203.

the trawl and hauling the same. There is no need to emphasize the risk of serious errors being introduced in assuming this figure. For example, in Table II., a series of deep-water forms, such as *Chimaera*, *Malacocephalus laevis*, *Scorpaena dactyloptera*, *Phycis blennioides*, etc., appears at a mean depth of 120–140 fathoms, but do not reappear until 180–200 fathoms. Here we may have a case of a haul in which the “mean depth” does not truly represent the actual depth at which the net has done most fishing.

The mean depth of all hauls, for which records of the catches have been kept, are grouped in Table II. in 20-fathom categories. The species recorded in the hauls falling within each category, are indicated below it by a cross (×) opposite the appropriate species. In this way some idea can be gathered both of the minimum or maximum depth, or both, at which a given species was taken in the trawl during these voyages.

The greatest range in depth was shown by the spini-dog (*Acanthias vulgaris*), which was taken at every depth from 90 to 520 fathoms.

Of fish of economic importance, hake and tusk had the widest range—namely, from the shallowest water worked down to 380–400 fathoms. The blackjack or coalfish (*Gadus virens*) was taken at all depths down to 240–260 fathoms. The haddock was taken at depths between 100–120 and 200–220 fathoms.

The halibut had a very narrow range—namely, between 260–280 and 300–320 fathoms,—but a single small specimen was taken in a haul shot in 520 fathoms and hauled in 504 fathoms, in approximate latitude 59° 26' N., longitude 6° 30' W.

Cod were taken in hauls of mean depth as great as 240–260 fathoms, and the common ling (*Molva vulgaris*) was taken from the shallowest water down to 320–340 fathoms. The deep-sea lings (*M. byrkelange* and *M. elongata*), on the other hand, ranged from 200–220 fathoms down to the deepest water worked. These two species are not distinguished in Tables I. and II. because some variation has been found in the specific characters which serve to distinguish them. Schmidt (2) found the fry of *Molva byrkelange* to the west of Scotland, but found the fry of the southern species (*Molva elongata*) at no station to the north of the latitude of south-west Ireland. Yet two specimens caught on these voyages, and examined ashore, more nearly approach *M. elongata* than *M. byrkelange*, and Davis (8) records *M. elongata* from the Lousy Bank, much further to the northward than the grounds we investigated.

The Chimæras taken were mostly *C. monstrosa*, but *C. mirabilis* was undoubtedly taken in our deepest haul on the Scottish Atlantic Slope (520–504 fathoms).

The blue whiting (*Gadus poutassou*) appeared at 120–140 fathoms, and continued to be present in the hauls down to the deepest water worked.

Of fish which may be definitely characterized as "deep-sea fish," *Spinax niger* was taken at 120–140 fathoms, reappeared at 180–200 fathoms, and continued to be taken down to 380–400 fathoms. Of the remaining deep-sea sharks, *Scymnorhinus licha* and *Centrophorus squamosus* appeared at 220–240 fathoms, *Centrophorus granulosus* and *Scymnodon ringens* at 240–260 fathoms.

Argentina silus appeared at 180–200 fathoms. The smaller species *Argentina sphyrena* was comparatively rarely met with, and then in much shallower water than *A. silus*. At other times I have seen *A. sphyrena* taken abundantly between 60 and 100 fathoms.

Aphanopus carbo appeared at 200–220 fathoms, *Epigonus telescopus* at 220–240 fathoms, *Mora mediterranea* and *Alepocephalus giardi* at 360–380 fathoms.

The Macrurids *Trachyrhynchus trachyrhynchus* and *Cælorhynchus cælorhynchus* were rarely taken, but *Malacocephalus laevis* was abundant and ranged from 120–140 fathoms to 260–280 fathoms. Farran (9) gives the "certain range" of *M. laevis* as 177–354 fathoms, and indicates in his diagram a maximum abundance at approximately 240 fathoms.

The Macrurid *Coryphæoides rupestris* had a range in our hauls from the 280–300-fathom category to the deepest water worked. Farran (9) gives the "certain range" of this species on the Irish Atlantic Slope as from 509–775 fathoms. However, *C. rupestris* is also recorded from 85 fathoms off Newfoundland, and from 164 fathoms in the Skagerrak.

EVIDENCE OF A BATHYPELAGIC HABIT IN DEEP-SEA FISH.

Günther (10) remarks of the deep-sea fish taken by the 'Challenger' that "some uncertainty prevails as regards the depths at which certain species were obtained," and agrees with a suggestion that "certain fishes live habitually in intermediate depths, without ever either coming to the surface or descending to the bottom." This suggestion is further developed by Hjort (3), and especially by Brauer (16).

Brauer has drawn up a list of all the species of deep-sea fish recorded by the 'Valdivia' Expedition and by previous expeditions. As a result of the 'Valdivia's' hauls with large

vertical nets, Brauer concludes that no fewer than 131 genera and 397 species, out of the total number of 309 genera and 1007 species of deep-sea fish, are pelagic—i. e., dwellers at intermediate depths of the ocean. Though these pelagic species may appear among the catch of a trawl towed along the sea-bottom at a great depth, it would, in their case, be wrong to state that they were caught at the depth at which the trawl was towed.

There is evidence that many of the fish, whose depth-distribution in our hauls is indicated in Table II., are mid-water forms. For example, the blue whiting (*Gadus poutassou*) was taken in our hauls at depths as great as 300 and 500 fathoms. But this is well known as a pelagic species. Schmidt (2) records its capture over great depths in the young-fish trawl. Hjort has also caught *Sebastes norvegicus* on floating long-lines, thus clearly proving its pelagic nature; yet in our hauls, as Table II. shows, it occurred apparently at depths between 100–120 and 260–280 fathoms. Moreover, it is hardly possible to believe that the common spur-dog (*Acanthias vulgaris*), which is at times so abundant in shallow coastal waters, and whose chief food-fishes are the herring and its allies, was actually taken in 500 fathoms, as Table II. would seem to indicate. It seems much more likely that, in many of our hauls, many of the species included in Table II. were caught by the trawl during hauling or shooting, at some intermediate depth in the water, and not on the bottom at the depth indicated by soundings.

It is well-known that, as Schmidt says (2), many species characteristic of the coast-banks may, when living on the continental slope where the bottom falls away very steeply, "lead a distinctly pelagic life . . . in the neighbourhood of such slopes, living exclusively on pelagic organisms." Hjort (3) also says "certain bottom-fishes are often found in mid-water, such as . . . the common dogfish (*Acanthias vulgaris*). Many fishes of the cod family lead a partly pelagic life, especially the saithe (*Gadus virens*), and sometimes also the cod, haddock, and others." I have shown elsewhere (12) that this pelagic habit has become more or less permanent in the hake (*Merluccius vulgaris*). During our cruises, *Gadus virens* was found to be feeding upon the pelagic fish *Gadus poutassou*. Therefore in the case of hake (*Gadus virens*), cod, haddock, *Sebastes norvegicus*, and probably also *Acanthias vulgaris*, the distribution in depth, and especially the lower limit of the distribution in depth, cannot satisfactorily be deduced from hauls with the trawl along the sea-bottom at

different depths, since these species may have been living pelagically at the time of capture.

But, in addition to these coastal forms, a number of species in Table II. may be regarded as definitely deep-sea fish, and there is evidence that some of these species are bathypelagic in habit.

Indirect evidence of a bathypelagic habit in a fish may be furnished (a) by the extent to which those species which have gas-bladders have these bladders forced out of the mouth, (b) by the nature of the stomach-contents, and (c) by the general form of the fish.

Direct evidence is furnished by the capture of the fish in mid-water.

Of the fish set down in Table II., tusk, the lings, hake, the Macrurids, *Phycis* and *Mora*, usually come up in the trawl with the stomachs everted, forced out of the mouth by the rapid expansion of the gas in the gas-bladder, and, on this evidence, it is probably correct to assume that these species have actually been caught on the bottom where the sounding indicates a considerable depth. But *Gadus virens*, *Sebastes*, *Scorpena*, *Gadus poutassou*, the Argentines, *Aphanopus carbo*, *Epigonus telescopus*, and *Alepocephalus giardi* are seldom found with everted stomachs, and when the trawl has been fishing in deep water it is fair to assume that these fish have been caught considerably above the bottom.

The Macrurids are probably bottom-feeders. *Malacocephalus laevis* feeds on bottom-haunting Crustacea, but *Coryphænoides rupestris* was found feeding on the bright red crustacean *Sergestes arcticus*, of which Kemp (11) writes:—"there is no certain record that it has ever occurred actually at the bottom" and is a "free-swimming species." Collett, quoted by Farian (9), says that specimens of *Coryphænoides rupestris* taken on lines at a depth of 100 fathoms in Norwegian fjords contained, as a rule, large Crustacea such as *Pandalus borealis*, *P. propinquus*, and *Pariphaë tarda*, which, according to Kemp, are bottom-living forms with the exception of *Pariphaë tarda*, which is frequently found swimming at intermediate depths. In *Coryphænoides berglax* Collett found *Hymedora glacialis*, which has never been found living actually on the bottom, besides the bottom-haunting *Pandalus borealis* and the Gasteropods *Buccinum* and *Fusus*.

Phycis feeds on Crustacea which almost certainly belong to the bottom-fauna, such as the crabs *Geryon* and *Gonoplax* and the prawns *Munida* and *Nephrops*. All the specimens

of *Mora* examined had everted stomachs, so that no information is available as to their food.

The pelagic nature of the food of *Gadus poutassou* and of the Argentines is described elsewhere (12). *Aphanopus carbo* was found feeding on the pelagic *Gadus poutassou*, and *Epigonus telescopus* on *Meganyctiphanes norvegica*—a fact which, at the depths (220–240 fathoms and deeper) over which this fish was taken, is sufficient proof of its bathypelagic nature.

Alepocephalus giardi was spawning at the time of these observations; eggs or milt would run from the vent on the slightest pressure, and the stomachs contained no food.

The hake was found to be feeding almost exclusively on the pelagic *Gadus poutassou*, while *Gadus virens*, on the Scottish Atlantic Slope, and in the western Faroe-Shetland Channel, was also feeding on *Gadus poutassou*, but east of long. 4° 17' W. *Gadus virens* contained in its stomach considerable quantities of herring-spawn, mixed with gravel and grit. In this locality at least, therefore, *Gadus virens* was certainly feeding on the sea-bottom.

Of the deep-water sharks, *Spinax niger* feeds almost exclusively on *Meganyctiphanes norvegica*, and *Scymnorhinus lichia*, whose stomach usually contains a large quantity of oil, has also been found containing the chopped-up fragments of *Spinax*. No observations are available for the food of the *Centrophorus* species nor for *Scymnodon ringens*. *Pristiurus* has been found with abundant *Meganyctiphanes* in its stomach.

When one considers the general form of the fish, it is obvious that the flat-fish, such as the halibut and megrim (*Arnoglossus laterna*) and also the monk (*Lophius piscatorius*), are bottom-haunting species. The shape of the Macrurids seems to point to a bottom habitat rather than to a pelagic habit of life. The tusk, the common ling (*M. vulgaris*), *Phycis*, *Mora*, and *Chimæra* have bodies and fins whose shape and general arrangement seem unsuitable for an active life in mid-water. The deep-sea lings, however, have an eel-like form which seems better adapted to a life in mid-water.

On the other hand, *Gadus virens*, the hake, *Gadus poutassou*, the Argentines, *Aphanopus carbo*, *Epigonus telescopus*, *Alepocephalus giardi*, and all the deep-sea sharks (*Spinax*, *Pristiurus*, *Scymnorhinus*, *Centrophorus*, *Scymnodon*) have a shape which makes it difficult to believe that they are habitually bottom-living forms.

Direct evidence of mid-water habit, by actual capture in mid-water, is available for many of these species. The hake was regularly fished for close to the surface, at night, with

baited hooks and trammel-nets (Duhamel du Monceau, 13); it is frequently caught in drift-nets shot for herring and mackerel; and in Spain it is caught on long-lines suspended above the sea-bottom (Santamaria, 14).

Gadus virens is also caught, commercially, on floating long-lines suspended close to the surface, at night, on the Norwegian coast-banks (le Gall, 15).

Gadus poutassou has been caught in mid-water by Schmidt (2) in the young fish-trawl.

Hjort (3) records the capture of a specimen of *Alepocephalus* in a tow-net towed 1000 metres above the sea-bottom in 5000 metres of water, between the Canaries and the Azores.

Finally, in February 1927 the Ministry of Agriculture and Fisheries' research vessel 'George Bligh,' in a series of experiments with vertical long-lines bearing baited hooks, caught *Spinax niger* 140 fathoms above the sea-bottom, in 300 fathoms of water; *Aphanopus carbo* at least 30 fathoms above the bottom, in 460 fathoms; and *Centrophorus squamosus* at least 70 fathoms above the bottom, in 460 fathoms. *Brama raii*, a species not found during our exploratory voyages, was also caught during these long-line experiments, at a height of at least 30 fathoms above the sea-bottom, in 160 fathoms.

CONCLUSIONS.

In Table II. is given the range, in fathoms, of thirty-six species of fish, as deduced from trawling experiments; but only those species which are most probably bottom-living forms can be considered as having been caught at the depth of the sea-bottom upon which the haul was made. By the term "bottom-living" one does not mean fish which are unable to leave the bottom, but fish which habitually live on the bottom or are free-swimming in the water-layers immediately above it, and which are to a great extent dependent upon the sea-bottom for their food. It is obvious that this must be a very elastic definition, since these "benthonic" forms are linked to the "pelagic" forms by such species as the hake (*Merluccius vulgaris*), blackjack (*Gadus virens*), cod, haddock, and spur-dog (*Acanthias vulgaris*), which, though they are strictly bottom-living forms, are able to live pelagically in the neighbourhood of the Continental Slope, especially where this is steep.

The tusk (*Brosmus brosme*), the ling (*Molva vulgaris*), the Chimæras, the Macrurids, *Phycis blennioides*, *Mora mediterranea*, *Arnoglossus laterna*, the halibut (*Hippoglossus*

vulgaris), and the monk (*Lophius piscatorius*) are probably bottom-living fish, whose range in depth is satisfactorily indicated by such observations as form the basis of Table II. *Coryphænoides rupestris* may contain Crustacea which have never been caught actually on the sea-bottom, but I have found the undoubtedly pelagic Crustacean *Meganyctiphanes norvegica* abundantly in the stomachs of the ray and of the megrim, and I have assumed that, in these cases, the fish have caught the pelagic Crustacea at some little distance above the sea-bottom, an assumption which is quite consistent with the definition of "bottom-living" fish given above.

On the other hand, evidence has been brought forward that the fish given in the list below are pelagic or bathypelagic—i. e., that their normal habitat is in mid-water. They are only affected by the sea-bottom to the extent that this may limit their geographical range when it rises too close to the surface to allow of the particular physical conditions which they require. Trawling experiments, therefore, must not be expected to give satisfactory data of their depth-distribution:—

Sebastes norvegicus, *Gadus poutassou*, *Pristiurus melanostomus*, *Spinax niger*, *Argentina silus*, *Aphanopus carbo*, *Scymnorhinus lichia*, *Centrophorus granulosus* and *C. squamosus*, *Epigonus telescopus*, *Scymnodon ringens*, and *Alepocephalus giardi*.

The last six species on the list, since they were not taken in water shallower than 200 fathoms (400 metres), are "bathypelagic" in the sense defined by Brauer (16).

Brauer states that all Salmonidæ (which include the Argentines), Trichiuridæ (which include *Aphanopus carbo*), Serranidæ (which include *Epigonus telescopus*), and Alepocephalidæ are pelagic. He is doubtful whether the Selachians should be considered pelagic or not.

SUMMARY.

1. A list of the sixty-one species of fish noted in the catches of the steam-trawler 'Florence Brierley' during her exploratory voyages in March, April, and May 1927, is given, with a comparison of the fish-faunas of the Faroe-Shetland Channel, the Scottish Atlantic Slope, and Rockall Bank.

2. A table is given of the range in depth of thirty-six of the most abundant species, as deduced from the depths of the hauls in which they were caught.

3. Many of the species given in this table are either

occasionally or permanently bathypelagic in habit, so that no conclusions as to their bathymetrical range are to be deduced from trawling experiments.

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XXIV.—*Tilapia esculenta*, a new Species of Cichlid Fish from the Victoria Nyanza, with Notes on the Habits of this Species and the nearly-related *Tilapia variabilis*, Blgr. By MICHAEL GRAHAM, M.A., of the Fisheries Laboratory, Lowestoft.

[Plates IX.-XI.]

WHILST about to engage on the Fishing Survey of Lake Victoria (1927-1928) I received a memorandum from Mr. C. M. Dobbs, Provincial Commissioner of the Nyanza Province of Kenya Colony, in which he stated that the Jalua Kavirondo natives engaged in the fishery distinguish two

nearly-resembling kinds of fish as "ngege" and "mbiru" respectively. Mr. Dobbs sent photographs, from which it appeared that one or both of these belonged to the species *Tilapia variabilis*, Blgr. (Cat. Afr. Fish. iii. p. 167, fig. 108). Mr. Dobbs's memorandum, with his photographs named by me, has been reproduced in the 'Journal of the East Africa and Uganda Natural History Society,' no. 30 (Nairobi, 1927).

An early opportunity was taken during the Fishing Survey of sending specimens of both kinds to Mr. Tate Regan, who gave the opinion that the "mbiru" is Boulenger's *Tilapia variabilis* and that the "ngege" is a separate species, so far undescribed. I am further indebted to Mr. Tate Regan for much assistance in the work of description.

The specific name *esculenta* is suggested, so as to express the fact that this is the important edible commercial species of Lake Victoria. Other species of the genus *Tilapia* are, of course, eaten, probably wherever they occur.

The accompanying table of the differences (p. 211) is based on an examination of forty-three specimens of *T. variabilis* and thirty-nine specimens of *T. esculenta*. The specimens of *T. esculenta* ranged from 134–366 mm. in total length, those of *T. variabilis* from 77 mm. to about 280 mm.

The type of *T. esculenta* is now in the British Museum (Natural History). This specimen is a mature male of 280 mm. length, with head 83 mm., diameter of eye 14 mm., interorbital width 40 mm., and preorbital 16 mm. It has five series of teeth in the upper jaw, three series of scales on the cheek, 23 gill-rakers on the whole anterior arch, 33 scales in longitudinal series, 5 from the origin of the dorsal fin to the lateral line, and XVII dorsal spines. There are 19 scales round the caudal peduncle and 9 over the top of it, excluding the lateral-line series. It has been drawn by Major W. P. C. Tenison (Pl. IX. fig. 1).

Boulenger's types of *T. variabilis* include two adult specimens of *T. esculenta*, and some young specimens in the Natural History Museum from Lake Gangu are probably also *T. esculenta*, including several specimens labelled "*T. eduardiana*."

The purpose of the highly ornate genital papilla in *T. variabilis* (Pl. IX. fig. 3) is obscure. In response to pressure the milt may be made to run into the cavity between the two basal lobes, and the shape of the organ suggests that it might be used for brushing the milt on to the ova. On the other hand, the very high colour would suggest that its function is at any rate partly decorative. It is, of course, a secondary sexual character, in that it is confined to adult males. I

	<i>T. esculenta</i> , sp. n.	<i>T. variabilis</i> , Blgr.
Depth of preorbital bone *	5 or more in length of head +.	Less than 5 in head in adults.
Series of teeth at front of upper jaw	2 (young) to 5 (adult).	4 (young) to 7 or more (adult).
Series of scales on cheek (below eye)	3 (2 in only four specimens out of thirty-nine).	2 (3 in one specimen out of forty-three).
Total number of gill-rakers on the anterior arch.	19-24.	23-27.
Scales in a longitudinal series	32-34.	29-32.
Series of scales from the origin of the dorsal fin to the lateral line.	5-5½.	4-4½.
Dorsal spines	XVII-XVIII (XVI in two specimens out of thirty-nine).	XVI-XVII (XV in two specimens out of forty-three).
Series of scales round the middle of the caudal peduncle.	18-20.	16-17.
Series of scales over the top of the middle of the caudal peduncle (excluding the two lateral-line series).	8-9.	7.
Genital papilla of adult male	Short (less than half an inch), entire, or once bifurcate.	Highly decorative roseate or orange, in the form of a tassel (Pl. IX, fig. 3).
Colour of upper parts	Brown, sometimes reddish.	Dark blue-grey or pale blue-grey, sometimes with a porcelain-like surface, or pale green.
Colour of belly	Cream to white.	Tinged with grey.
Colour of fins	Sometimes tinged with red, but this colour is not localized at the tips of the rays.	Dorsal and caudal fins tipped with scarlet in the adult and half-grown.

* Measured on a line running from the centre of the eye roughly parallel with the upper profile.

+ Measured from the tip of the snout to the posterior margin of the operculum.

never observed the short papilla of *T. esculenta* to be developed in this manner.

The pale blue-grey coloured individuals of *T. variabilis* are found in the rivers, and the porcelain-like surface sometimes found in the males seems to be associated with ripe gonads.

The dark blue-grey *T. variabilis* is common in the normal muddy habitat, but on sandy bottoms the fish are all of the pale green colour. This colour-difference is still to be seen in specimens which were fixed in formalin for twelve hours, and have been preserved in spirit for four months.

The type figured by Boulenger (*loc. cit.*) is a comparatively rare colour-variety of *T. variabilis*; in life this is a brilliant orange and red colour, with black blotches dorsally. A typical specimen of *T. variabilis*—an adult male—is shown in Pl. IX. fig. 2.

Blackness of the pelvic fins in adult males is a secondary sexual character found in both species of *Tilapia* and in all the other species of Cichlidæ taken by me in Lake Victoria.

It will be observed in the table that most of the diagnostic characters show overlapping variation in the two species, but adults of the two species are readily distinguishable in the field, because *T. variabilis* has a more markedly convex upper profile than *T. esculenta*. In some young specimens this distinction is probably the best guide, although it is not so marked as in the adults. In adults the colour of the belly and the tips of the dorsal spines form good criteria.

The gill-rakers differ in the two species not only in number but also in their shape and spacing on the arch. In Pl. X. the arches from half-grown specimens of each species are compared.

T. variabilis is said neither to cure nor travel so well as *T. esculenta*, owing to an excess of oil.

In places where there is not much fishing for them both species are likely to be represented by some oddly shaped and heavily spined specimens. In Pl. XI., *b*, *c*, and *d*, photographs of such specimens of *T. esculenta* are shown for comparison with the type-specimen, *a*. These appear to be older fish; they are usually longer than the normally grown individuals.

The two species appear to agree in the habit of feeding on phytoplankton, which they comb off the weeds or off the lake-bottom, but they differ in regard to the depth and distance from the shore at which they are found abundantly. *T. variabilis* is common in rivers and near the lake-shore, whereas *T. esculenta* is found abundantly in water of about 3 fathoms and from 1 to 6 miles from the shore, especially in the large

shallow gulfs. (The distribution of *T. variabilis* is therefore in the region of abundant crocodiles. This is of some economic importance, since the latter interfere with fishing operations.)

The natives of the lake-shore do not always distinguish the two species. The Kavirondo almost invariably do, the Baganda generally do so, but the various Tanganyika tribes usually make no distinction.

EXPLANATION OF THE PLATES.

PLATE IX.

- Fig. 1. *Tilapia esculenta*, sp. n. From a specimen fixed in formalin and preserved in spirit. The opercular spot appears considerably darker in this drawing of a preserved specimen than in life. The short genital papilla has undergone shrinkage. Drawing by Major W. P. C. Tenison of the type-specimen. $\times \frac{1}{2}$.
- Fig. 2. *Tilapia variabilis*, Blgr. This specimen is more nearly typical than the type figured by Boulenger (*loc. cit.*). In a fresh specimen the opercular spot would appear lighter relatively. The genital papilla, which in life is a delicate structure (see fig. 3), has undergone considerable shrinkage so as to have the appearance figured. Drawing by Major W. P. C. Tenison. $\times \frac{1}{2}$.
- Fig. 3. A sketch to show something of the appearance of the genital papilla in living adult male specimens of *Tilapia variabilis*. This organ is bright red and orange in colour and extremely delicate distally. Sketch by author. $\times \frac{1}{2}$.

PLATE X.

A photograph showing the anterior gill-arches of *Tilapia esculenta*, sp. n. (A), and *Tilapia variabilis*, Blgr. (B). It is observed that the gill-rakers differ in shape and spacing on the arch and in number. The specimens were 191 mm. and 197 mm. in total length respectively. Photographed by H. Stokes of the Fisheries Laboratory. $\times 1\frac{1}{2}$.

PLATE XI.

Photographs of oddly shaped and heavily spined specimens (*b, c, d*) of *Tilapia esculenta*, sp. n., to compare with the type (*a*). It seems probable that *b, c*, and *d* are older fish. Photographs by the author. $\times \frac{1}{16}$.

XXV.—A new Species of *Megamelanus*, Ball, from Bermuda (*Homoptera*, *Delphacidae*). By F. MUIR, Hawaiian Sugar Planters' Experiment Station, Honolulu, T.H.

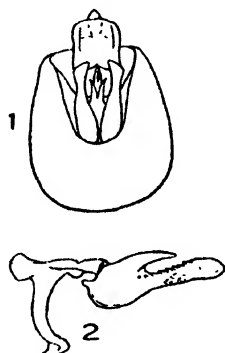
Megamelanus graminicola, sp. n.

Brachypterous male; length 2.2 mm.; tegmen 1.7 mm.

Pronotum and mesonotum together longer than vertex (1.5 to 1), vertex about 1.5 times the length of the pronotum.

In outline vertex turbinate, projecting beyond eyes as much as the length of the eyes, base slightly concave, a little behind the middle of eyes; a simple longitudinal median carina on the basal two-thirds. Frons subtruncate in outline, length nearly twice the width, widest on apical third, apex slightly narrowed, a simple median longitudinal carina on basal half or slightly beyond; median carina of clypeus distinct, lateral carinae absent or obscure. Lateral pronotal carinae straight, subparallel, reaching hind margin. Hind basitarsus equal to the other two together, spur shorter than basitarsus, narrow, concave on inner surface, ten distinct teeth on hind margin. Tegmina narrow, reaching beyond the apex of abdomen; wings absent.

The genitalia are figured; the anal segment has no armature; the armature of the diaphragm forming two small



Megamelanus graminicola, sp. n.

Fig. 1.—Full view of pygofer.

Fig. 2.—Lateral view (left side) of aedeagus, bridge, chamber, and apodeme of genital styles.

spines arising from the middle of the dorsal margin, curved slightly laterally. The aedeagus has a conspicuous, large, spine-like process arising from the basal third on the dorsal aspect and reaching about one-third from the apex. A row of about seven teeth runs from near apex on dorsal aspect to about a third from base along the dorso-lateral aspect; a few teeth arise on the right side of the apical third; the orifice is near the apex on right side. Vertex, pronotum, and mesonotum stramineous or light brown, the median carinae of the vertex, pronotum, and mesonotum lighter; frons darker, especially along the lateral margins. Legs stramineous, hind femora brown. Abdomen dark brown. Tegmina dark brown, light over clavus and costa, commissure still lighter.

The female is similar in build and colour to the male. In some specimens the tegmina and abdominal tergites are lighter than in the type.

BERMUDA: Southampton Parish, from grass on the south shore, vi. 1927 (*L. Ogilvie*).

Described from eleven specimens.

In the macropterous forms the tegmina are likely to be broader and the wings will be present. In general build this species comes near to *M. elongatus*, Ball, but the genitalia are distinct. In the genitalia this species appears to be nearest to *M. terminalis*, Metc.

XXVI—*New Species of Heterocera from Formosa and the Philippines*. By A. E. WILEMAN, F.E.S., and R. J. WEST.

[Ridgway has been used as the colour-standard. Colour-terms in italics are not Ridgway's. Patagium=collar-tippet; tegula=wing-base cover. All types in Collection Wileman.]

Ilema incurvata, sp. n.

Male.—Palpus, second segment light orange, third segment fuscous. Antenna, shaft raw umber, ciliated, with paired setæ, the latter about three times the length of cilia. Head: frons blackish brown, vertex and occiput chamois. Thorax blackish brown, patagium light buff anteriorly, blackish brown posteriorly, tegula light buff anteriorly, blackish brown posteriorly, terminating with long blackish-brown hair-scales. Abdomen light buff with hair-brown tuft of hairs from base to middle above, light buff beneath, anal tuft cinnamon-buff. Pectus cinnamon-buff. Legs hair-brown, tibiæ and tarsi blackish brown above. Fore wing long and narrow, ground-colour light buff, a small patch of blackish brown at base, a long blackish-brown patch in lower half of wing, reaching from antemedial to postmedial fasciæ, upper edge along top of cell and vein 6, lower edge on inner margin for a short distance then gradually rising to vein 2; on costa near postmedial fascia a blackish-brown tooth-shaped mark curving inwards from this mark to apex, costa edged with blackish brown, cilia blackish brown; a fold in distal two-thirds of cell, in basal third a flap of light buff scales, overlapping cell and basal end of long blackish-brown patch; under side fuscous medially, bordered by warm buff, fuscous along costa and cilia. Hind wing warm buff with faint buffy-brown subterminal band; underside similar, band not so plainly marked.

Expanse 40 mm. (tip to tip 38 mm.).

Female.—Similar to male, but without the flap of light buff scales on costa.

Expanse 44 mm. (tip to tip 42 mm.).

Holotype (♂). Kanshirei, Formosa, 1000 ft., 20. iv. 1906.

Allotype (♀). Kanshirei, Formosa, 1000 ft., 20. iv. 1906.

Paratype (♂). Kanshirei, Formosa, 1000 ft., 19. iv. 1906.

Paratype (♀). Kanshirei, Formosa, 1000 ft., 20. iv. 1906.

This species is near to *I. tetragona*, Wlk., but differs in the following features: larger size, wings longer, blackish-brown patch on fore wing longer, hind wing with a buffy-brown band.

Ilema nebra, sp. n.

Male.—Palpus (description impossible as both are missing). Antenna, shaft light drab, ciliated, with paired setæ, the latter about three times the length of cilia. Head: frons, vertex, and occiput light drab. Thorax, patagium and tegula light drab. Abdomen light drab above and beneath, anal tuft buffy brown. Legs drab-grey, tarsus of fore leg drab. Fore wing narrow, both upper and under side uniform light drab. Hind wing drab-grey above and beneath.

Expanse 16 mm. (tip to tip 13 mm.).

Holotype (♂). Kolambugan, subprov. Lanao, Mindanao (plains), 17. v. 1914.

This species closely resembles *I. decreta*, Butl., in build and size but differs in colour.

Ilema ochroleuca, sp. n.

Male.—Palpus small, drab-grey. Antenna ciliated, shaft white for basal third, distal two-thirds buckthorn-brown. Head: frons drab, vertex white and ochraceous-buff, occiput white. Thorax white, patagium ochraceous-buff, a little white anteriorly, tegula white with a streak of ochraceous-buff in centre. Abdomen white above, ochraceous-buff beneath, anal tuft drab-grey. Pectus white. Legs: fore leg outwardly white, inwardly drab, mid and hind legs white. Fore wing upper side white, costa edged with ochraceous-buff from base to end of cell, an ill-defined, faint, orange streak from the upper angle of cell to apex. Under side white, ochraceous-buff along and below costa bordering a drab patch in distal half of cell. Hind wing upper side white, under side white with a faint tinge of ochraceous-buff on inner margin.

Expanse 22 mm. (tip to tip 21 mm.).

Female.—Differs from the male as follows:—two minute spots of ochraceous-buff on vertex, patagium with very little

ochraceous-buff, tegula white. Fore wing upper side white, with a tinge of ochraceous-buff at base of costa, under side less ochraceous-buff on costa.

Expanse 24 mm. (tip to tip 23 mm.).

Holotype (♂). Sapiangao, subprov. Benguet, Luzon, 5500 ft., 15. xii. 1912.

Allotype (♀). Sapiangao, subprov. Benguet, Luzon, 5500 ft., 17. xii. 1912.

Paratype (♀). Palali, subprov. Benguet, Luzon, 2000 ft., 26. xii. 1912.

This species is similar to *I. degenerella*, Wlk., which has under side of fore wing entirely fuscous and lacks the ochraceous-buff.

Mantala lepta, sp. n.

Female.—Palpus small, cartridge-buff. Antenna ciliated, with long paired setæ. Head and thorax cartridge-buff suffused with warm buff. Abdomen cartridge-buff suffused with warm buff, with hair-like scales on the three basal segments above, venter similarly coloured. Pectus and legs cartridge-buff. Wings, both fore and hind, cartridge-buff, delicate in build.

Expanse 28 mm. (tip to tip 26 mm.).

Holotype (♀). Haight's Place, Pauai, subprov. Benguet, Luzon, 7000 ft., 25. vi. 1913.

Monosyntaxis ochrosphena, sp. n.

Male.—Palpus small, second segment antimony-yellow, third fuscous-black. Antenna: shaft fuscous-black, pectinated, pectinations ciliated. Head: frons and vertex fuscous-black mixed with glossy Prussian-blue, occiput fuscous-black. Thorax fuscous-black, patagium and tegula fuscous-black mixed with glossy Prussian-blue scales. Abdomen covered with fuscous-black hair-like scales above, antimony-yellow beneath, anal tuft fuscous-black. Pectus antimony-yellow. Legs: coxa antimony-yellow, femur upper end antimony-yellow, lower fuscous-black mixed with glossy Prussian-blue, tibia and tarsus fuscous-black and glossy Prussian-blue mixed. Fore wing glossy, almost metallic, dusky slate-violet, suffused with blackish violet, the basal half, especially along costa and below cell, longitudinally streaked with glossy Prussian-blue; a triangular antimony-yellow patch in basal third of wing. Under side similar, but antimony-yellow patch is not so cleanly outlined. Hind wing triangular in shape, upper side fuscous-black with antimony-yellow on and just below costa for about two-thirds; under side similar, but antimony-yellow covers more of the wing reaching to median nervure.

Expanse 34 mm. (tip to tip 31 mm.).

Holotype (♂). Baguio, subprov. Benguet, Luzon, 5000 ft., iii. 1913.

This species closely resembles *M. holman-hunti*, Hmps., which, however, has a rounded red spot at base of fore wing.

Pachycerosia lutulenta, sp. n.

Female.—Palpus small, light drab. Antenna (impossible to describe as both are missing). Head: frons and vertex, pale drab-grey, occiput drab. Thorax drab, patagium and tegula drab. Abdomen drab above and beneath, anal tuft pale drab-grey. Pectus light drab. Legs drab-grey. Fore wing upper side drab-grey irrorated with fuscous, no definite pattern, but at different points the fuscous predominates forming ill-defined spots—one at base, two antemedially on costa and in cell; two postmedially on costa and near lower angle of cell; subterminal area has more fuscous, making it a darker shade than the rest of the wing, under side light drab. Hind wing upper side hair-brown, under side light drab.

Expanse 20 mm. (tip to tip 19 mm.).

Holotype (♀). Klondyke, subprov. Benguet, Luzon, 800 ft., 20. v. 1912.

Cyana phycomata, sp. n.

Male.—Palpus ochraceous-buff. Antenna minutely ciliated, with paired setæ. Head: frons and vertex white, occiput ochraceous-buff. Thorax white, patagium apricot-orange, tegula white anteriorly, terminating with apricot-orange hair-like scales. Abdomen ochraceous-buff above and beneath. Pectus ochraceous-buff. Legs ochraceous-buff, excepting femur and tibia of fore leg which have white inwardly. Fore wing with termen produced from rounded apex to vein 7, then slightly incurved to tornus; upper side ground-colour white, subbasal band of apricot-orange outwardly edged with fuscous-black which increases in width to form a spot in cell and another near inner margin; antemedial band of apricot-orange inwardly edged with fuscous-black, excurved to median nervure then almost straight to inner margin, a prominent spot of fuscous-black on discocellulars, postmedial band of apricot-orange outwardly edged with fuscous-black, apical and subterminal area warm buff with slight tinge of apricot-orange; a flap of scales on costa from antemedial to postmedial band extending to middle of cell. Under side white suffused with warm buff, a pouch or fold below costa, its position corresponding to flap of scales on upper side. Hind wing warm buff above and beneath.

Expanse 36 mm. (tip to tip 33 mm.).

Holotype (♂). Kolambugan, subprov. Lanao, Mindanao (plains), 21. vi. 1914.

This species is very near *C. lunulata*, Semper, but differs from it in the direction and width of the bands and in the shape of the discocellular spot.

Cyana crasizona, sp. n.

Female.—Palpus English-red. Antenna minutely ciliated, with paired setæ. Head: frons and vertex white. Thorax white, with a band of English-red across middle, and again English-red posteriorly, patagium and tegula white edged with English-red. Abdomen ochraceous-buff above and beneath. Pectus white. Legs: fore and mid legs, coxæ white, femora English-red above, white beneath, tibiæ English-red with white band at centre, tarsal segments English red, white at joints, hind leg, coxa, and femur white, tibia ochraceous-buff above, white beneath, tarsal segments ochraceous-buff, white at joints. Fore wing, upper side ground-colour white, subbasal band of English-red, wide at costa and inner margin, narrow in centre, outwardly edged with fuscous-black, which increases in width into two patches, one in cell and the other near inner margin; an antemedial band of English-red inwardly edged with fuscous-black, excurved about two-thirds of length then straight to inner margin; two fuscous-black spots, one in cell at two-thirds, the other on discocellulars; a postmedial band of English-red outwardly edged with fuscous-black with two indentations; apical and subterminal areas ochraceous-orange. Underside ochraceous-buff with markings of upper side faintly showing. Hind wing ochraceous-buff above and beneath.

Expanse 36 mm. (tip to tip 33 mm.).

Holotype (♀). Kolambugan, subprov. Lanao, Mindanao (plains), 21. v. 1914.

This species is very close to *C. lunulata*, Semper, but differs in having two spots on fore wing, one in the cell, the other on discocellulars, and has larger white area.

Eurosia fuscipunctata, sp. n.

Male.—Palpus second and third segments fuscous, white at joint and tip. Antenna ciliated, with paired setæ. Head: frons and vertex pale drab-grey, occiput fuscous. Thorax drab-grey, patagium and tegula pale drab-grey. Pectus drab-grey. Abdomen drab-grey above and beneath, anal tuft pale drab-grey. Legs: fore leg drab-grey with some fuscous on upper side of femur and tibia, tarsal segments fuscous

ringed with pale drab-grey at joints; mid-leg drab-grey with some fuscous on tibia, tarsus similar to fore leg, hind leg drab-grey. Fore wing, upper side pale drab-grey without fasciæ, but with small fuscous spots on costa at the usual points of origin of all fasciæ, one at apex, and interneural spots on termen, a small spot at base of cell, another at lower angle; underside drab-grey. Hind wing upper side drab-grey, underside pale drab-grey with drab-grey in subcostal area.

Expanse 22 mm. (tip to tip 21 mm.).

Holotype (♂). Baguio, subprov. Benguet, Luzon, 5000 ft., 19. vi. 1913.

This species is near *E. trimaculata*, Hmps., but is more delicate in build.

Eurosia hammatocera, sp. n.

Male.—Palpus raw sienna. Antenna with the ^{abx} _{Ex?} ^{set} thickened at about one-seventh, ciliated, with paired setæ. Head: frons and vertex raw sienna. Thorax, patagium, and tegula yellow-ochre. Abdomen fuscous, anal tuft yellow-ochre. Pectus ochraceous-buff. Legs: fore and mid legs ochraceous-buff, with fuscous on upper side of tibiæ and tarsi; hind leg ochraceous-buff with fuscous on tarsus. Fore wing, upper side yellow-ochre, costa edged with fuscous; underside yellow-ochre, proximal half from costa to near anal vein enriched with raw sienna, with a cinnamon-brown patch medially. Hind wing yellow-ochre, proximal three-quarters suffused with cinnamon-brown; underside yellow-ochre with raw-sienna streaks through lower half of cell.

Expanse 22 mm. (tip to tip 21 mm.).

Holotype (♂). Trinidad, Baguio, subprov. Benguet, Luzon, 5000 ft., 31. iii. 1912.

This species is near *E. acanthocera*, Hmps., but differs in having a longer fore wing, termen more oblique, and hind wing with cinnamon suffusion.

Eugoa mindanensis, sp. n.

Male.—Palpus light buff, fuscous above. Antenna minutely ciliated, with paired setæ. Head: frons and vertex light buff. Thorax, patagium, and tegula light buff. Abdomen light buff above and beneath, anal tuft warm buff. Pectus and legs light buff. Fore wing cartridge-buff lightly tinged with fuscous, a fuscous-black spot on discocellulars, an oblique, slightly incurved, fuscous shade from costa near apex to inner margin at two-thirds, proximal edge clearly defined, distal edge suffused into ground-colour; hind wing

cartridge-buff tinged with fuscous; underside, fore and hind wings light drab.

Expanse 18 mm. (tip to tip 17 mm.).

Holotype (♂). Kolambugan, subprov. Lanao, Mindanao (plains), 21. vi. 1914.

Nearest ally, *E. bipuncta*, Heylaerts, from Java and Singapore.

Siccia discrepans, sp. n.

Male.—Palpus drab-grey. Antenna ciliated, shaft drab. Head: frons and vertex light drab, with pale drab-grey scales forming band between bases of antennae, occiput light drab. Thorax drab-grey, patagium pale drab-grey, tegula light drab. Abdomen drab-grey above and beneath, anal tuft light drab. Fore wing upper side pale drab-grey with fuscous spot at base of costa, fuscous patch on antemedial fascia from costa to median nervure, and fuscous spots on costa at medial, postmedial, and subterminal fasciae, another at lower angle of cell, and an outwardly curved row of minute fuscous spots from the spot on costa postmedially to tornus. Underside pale drab-grey with pearly sheen and four, faint, fuscous spots on costa. Hind wing, upper side pale drab-grey, underside pale drab-grey with pearly sheen.

Expanse 16 mm. (tip to tip 14 mm.).

Holotype (♂). Klondyke, subprov. Benguet, Luzon, 800 ft., 4. iii. 1912.

Paratype (♂). Klondyke, subprov. Benguet, Luzon, 800 ft., 12. v. 1912.

Ctenane dealbata, sp. n.

Male.—Palpus (description impossible as both are missing). Antenna: shaft light drab, pectinated, pectinations ciliated. Head: frons and vertex pale drab-grey. Thorax, patagium, and tegula pale drab grey. Abdomen pale drab-grey above and beneath, anal tuft light drab. Pectus pale drab grey. Legs: coxae, femora, and tibiae light drab, tarsi fuscous with pale drab-grey scales at joints of segments. Fore wing upper side cartridge-buff tinged with pale drab-grey, fuscous along costa, fuscous medial fascia, and a large patch of fuscous from lower half of medial fascia, broadening to apex and termen and leaving a cartridge-buff patch from end of cell to just before apex; underside cartridge-buff tinged pale drab-grey, with patch of fuscous-black below costa in distal half of cell. Hind wing, upperside cartridge-buff tinged with pale drab-grey, fuscous-black patch below costa; underside similar, with scattered fuscous scales below costa, and fuscous-black patch showing through from upper side.

Expanse 16 mm. (tip to tip 15 mm.).

Holotype (♂). Klondyke, subprov. Benguet, Luzon, 800 ft., 22. iii. 1912.

This species is near *C. labuana*, Swinh., but differs in being larger, and in having more fuscous on fore wing, and a straight medial fascia.

Mittochrista lutivittata, sp. n.

Female.—Palpus zinc-orange. Antenna minutely ciliated, with paired setæ. Head: frons and vertex zinc-orange. Thorax, patagium, and tegula zinc-orange tinged with grenadine-red. Abdomen drab above and beneath. Pectus drab. Legs: fore and mid legs carrot-red, hind leg drab. Fore wing, upper side zinc-orange tinged with grenadine-red, with dark greyish-olive lines and spots in the following positions:—a diagonal line from costa antemedially to inner margin subbasally, another diagonal line from costa antemedially to inner margin just before the deeply-bowed postmedial fascia, to which it is joined near the inner margin by a short bar; a spot at base of cell, one on discocellulars, and three in subterminal area as follows:—a small one at the junction of veins 8 and 9, a larger one on vein 6, and another on vein 4, the two latter touching the postmedial fascia; underside carrot-red. Hind wing, upper and under sides flesh-colour.

Expanse 18 mm. (tip to tip 16 mm.).

Holotype (♀). Klondyke, subprov. Benguet, Luzon, 800 ft., 10. iii. 1912.

This species is near *M. exclusa*, Butl., similar in colour but smaller, and markings on fore wing different.

Mittochrista rhipiptera, sp. n.

Male.—Palpus fuscous, white beneath and at tip. Antenna, shaft fuscous with cream-colour above at base for about a quarter of the length, ciliated, with paired setæ. Head: frons and vertex cream-colour. Thorax cream-colour with some fuscous on metathorax, patagium cream-colour, tegula cream-colour with fuscous spot anteriorly. Abdomen buff-yellow above and beneath. Pectus cream-colour. Legs: coxæ, femora, and tibiæ cream-colour with some fuscous outwardly, tarsi fuscous. Fore wing upper side marguerite-yellow, costa edged with fuscous at base as far as antemedial fascia; other fuscous marks as follows:—one spot at base, another in cell at subbasal fascia; three spots antemedially, one below costa, one on median nervure, another near inner margin; the medial fascia has at the costa a V-shaped mark, with the point of the V touching

the upper edge of the cell, a spot on median nervure, and at inner margin an incomplete inverted V-shaped mark; a spot on discocellulars, and from postmedial fascia to apex and termen the veins are fuscous, giving the appearance of radiating lines, the lower one of these has at its commencement a short dash to inner margin. Underside white tinged with marguerite-yellow, costa edged with fuscous at base for about a third of its length, some fuscous above middle of cell, a faint spot on discocellulars, and veins in the apical area fuscous. Hind wing, upper and under sides white tinged with marguerite-yellow.

Expanse 28 mm. (tip to tip 27 mm.).

Holotype (♂). Baguio, subprov. Benguet, Luzon, 5000 ft., 18-24. iii. 1912.

This species is near *M. zebrina*, Moore, but is larger, the markings on fore wing are slightly different, and there are no markings on hind wing as in that species.

Amalodeta tineoides, sp. n.

Female.—Palpus pale drab-grey. Antenna, shaft fuscous-black, minutely ciliated, with paired setæ. Head: frons pale drab-grey, vertex pale drab-grey with fuscous posteriorly. Thorax drab-grey, patagium and tegula fuscous-black bordered with pale drab-grey. Abdomen drab-grey above and beneath. Pectus and legs drab-grey. Fore wing drab-grey with fuscous-black spots as follows:—one subbasally in cell; four antemedially on costa, top of cell, median nervure, and vein 1; four postmedially at upper and lower angle of cell, vein 2, and vein 1; underside fuscous. Hind wing pale drab-grey above and beneath.

Expanse 18 mm. (tip to tip 17 mm.).

Holotype (♀). Sapianguo, subprov. Benguet, Luzon, 5800 ft., 11. xii. 1912.

Baroa punctibasalis, sp. n.

Male.—Palpus upturned, first and second segments fuscous-black above and on sides, white beneath, extending all round at junction of second and third segments, third segment fuscous-black. Antenna: shaft fuscous, white on basal fifth, ciliated, with paired setæ. Head: frons white, vertex white with fuscous wedge-shaped patch in centre, occiput fuscous-black. Thorax white with fuscous-black spot between tegulæ, patagium white with fuscous-black spot in centre, tegula white with two fuscous-black spots, one anteriorly, the other posteriorly. Abdomen drab above and beneath, anal tuft ochraceous-buff. Pectus pale drab-grey. Legs:

fore leg pale drab-grey with fuscous inwardly, other legs pale drab-grey tinged with fuscous on tarsi. Fore wing, upper side a light shade of avellaneous, not quite so light as tilleul-buff, with seven fuscous-black spots in basal third, grouped as follows:—one at base of cell, one in middle of cell, three in a row above, and two below the basal half of cell. Underside cartridge-buff, with slightly paler shade along inner margin and termen. Hind wing upper side cartridge-buff, underside smoke-grey.

Expanse 30 mm. (tip to tip 29 mm.).

Holotype (♂). Montalban, prov. Rizal, Luzon (plains), 29. i. 1914.

Paratype (♂). Montalban, prov. Rizal, Luzon (plains), 6. ii. 1914.

Paratype (♂). Montalban, prov. Rizal, Luzon (plains), 26. iii. 1912.

This species is near to *B. punctivaga*, Wlk., but differs in the colour being paler and in having spots only in the basal third of fore wing.

XXVII.—*Four new Cichlid Fishes from Lake Victoria.*

By C. TATE REGAN, F.R.S., and ETHELWYNN TREWAVAS, B.Sc.

Haplochromis plagiodon, sp. n.

Depth of body 3 in length, length of head $3\frac{1}{4}$. Snout as long as eye, the diameter of which is $3\frac{3}{8}$ in length of head, greater than depth of præorbital or cheek. Interorbital width $3\frac{1}{4}$ in length of head. Jaws equal anteriorly; maxillary extending to below anterior edge of eye; teeth of outer series with long oblique anterior cusp and minute posterior cusp, 36 in upper jaw, the anterior rather large; two inner series of minute teeth. 3 series of scales on cheek. 7 gill-rakers on lower part of anterior arch. Lower pharyngeal not enlarged, but middle teeth rather stout, subconical. 32 scales in a longitudinal series, 6 from origin of dorsal to lateral line; pectoral scales very small. Dorsal XV 10; last spine a little less than $\frac{1}{2}$ length of head. Anal III 8; third spine $\frac{2}{3}$ length of head. Pectoral nearly as long as head, not quite reaching anal. Caudal truncate. Caudal peduncle $1\frac{1}{2}$ as long as deep. About 8 dark cross-bars on body; pelvics blackish; ocellar spots on anal.

A single specimen, 100 mm. in total length, from Sesse Islands (Coll. Bayon).

This specimen had been determined by Boulenger as *Hemitilapia bayoni* (= *Haplochromis obliquidens*), but differs in having fewer teeth with a distinct posterior cusp. The teeth resemble in structure those of *Bayonia xenodonta*, the type of which has kindly been sent for comparison by Dr. D. Vinciguerra. The teeth of *Bayonia xenodonta* are fewer and larger, 24 in outer series of upper jaw, as described by Boulenger; in addition, they form a double series on each side of the upper jaw, with about six inner teeth nearly as large as the outer; anteriorly there are two inner series of minute teeth.

In the structure and dentition of the lower pharyngeal *H. plagiodon* resembles *H. humilior*, which is distinguished by the narrower interorbital region and the more numerous teeth, the outer with subequal cusps. It is probably related to *H. humilior*.

Haplochromis diplotænia, sp. n.

Depth of body $3\frac{3}{4}$ in length, length of head $2\frac{3}{8}$. Snout a little longer than diameter of eye, which is $3\frac{1}{2}$ in length of head, much greater than depth of præorbital or cheek. Interorbital width 5 in length of head. Lower jaw slightly projecting; maxillary not extending to below eye. Teeth in 4 series in upper jaw, 3 in lower; outer series bicuspid, 50 in upper jaw. 4 series of scales on cheek. 9 gill-rakers on lower part of anterior arch. Pharyngeal teeth small. 33 scales in a longitudinal series, 6 or 7 from origin of dorsal to lateral line. Dorsal XV 10; last spine $\frac{1}{2}$ length of head. Anal III 8; third spine stronger than and nearly as long as last dorsal. Pectoral $\frac{3}{8}$ length of head, not reaching anal. Caudal truncate. Caudal peduncle twice as long as deep. An opercular spot; a blackish lateral band becoming fainter on caudal fin, a second above upper lateral line; a series of dark spots at base of dorsal.

A single specimen 110 mm. in total length (coll. M. Graham).

Related to *H. tæniatus*, but more slender, head smaller, snout shorter, mouth smaller, eye larger, etc.

Haplochromis eutænia, sp. n.

Depth of body $3\frac{1}{2}$ in length, length of head $2\frac{1}{4}$. Snout a

little longer than diameter of eye, which is $3\frac{1}{2}$ in length of head, greater than depth of cheek or præorbital. Interorbital width $4\frac{1}{2}$ in length of head. Mouth a little oblique; lower jaw slightly projecting; maxillary extending to below anterior edge of eye. Teeth small, in 2 or 3 series, outer mostly bicuspid, about 75 in outer series of upper jaw. 3 or 4 series of scales on cheek. 8 gill-rakers on lower part of anterior arch. Pharyngeal teeth small. 31 scales in a longitudinal series, 5 between origin of dorsal and lateral line. Dorsal XV 9; last spine $\frac{1}{3}$ length of head. Anal III 8; third spine stronger than and as long as last dorsal. Pectoral a little shorter than head, reaching anal. Caudal truncate. Caudal peduncle $1\frac{2}{3}$ as long as deep. A dark lateral band, interrupted in the middle, extending from opercular spot to end of caudal; two dark bars across snout and some dark spots on back; soft dorsal with a well-marked ocellus; anal with two ocelli; pelvics blackish.

A single specimen, 105 mm. in total length (coll. M. Graham).

Related to *H. microdon* and *H. flavipinnis*.

Haplochromis tridens, sp. n.

Depth of body $3\frac{1}{2}$ in length, length of head $2\frac{4}{5}$. Snout acute, a little longer than eye, the diameter of which is $3\frac{1}{2}$ to $3\frac{2}{3}$ in length of head, greater than depth of cheek, much greater than præorbital depth. Interorbital width 5–5½ in length of head. Lower jaw strongly projecting; maxillary reaching vertical from anterior edge of eye. Teeth in 3 or 4 series; outer mostly tricuspid, 70–80 in outer series of upper jaw. 4 series of scales on cheek. 9 or 10 gill-rakers on lower part of anterior arch. Pharyngeal teeth small. 33 scales in a longitudinal series, 5 or 6 from origin of dorsal to lateral line. Dorsal XV–XVI 9; last spine $\frac{1}{3}$ length of head. Anal III 8; third spine stronger and a little shorter than last dorsal. Pectoral a little shorter than head, extending to above anal. Caudal truncate. Caudal peduncle $1\frac{1}{2}$ as long as deep. An opercular spot, and a lateral band most distinct posteriorly.

Two specimens, 135 and 140 mm. in total length (coll. M. Graham).

Perhaps nearest to *H. acutirostris*.

XXVIII.—*Thysanoptera from Abyssinia.*
By DUDLEY MOULTON, San Francisco, California.

THIS paper has been made possible through the courtesy of Mr. Frederick Laing of the British Museum, London, who has kindly submitted to me for identification eighteen vials of specimens collected by Dr. Hugh Scott and Mr. J. Omer-Cooper in Abyssinia. I wish here to express my appreciation to Mr. Laing and also to Messrs. Scott and Omer-Cooper for the most excellent condition of the material and the large number of specimens collected, making it possible in many cases to prepare a large series of slides.

Family Thripidæ, Uzel.

Subfamily CHIOTHRIPINÆ, Karny.

1. *Chiothrips manicatus*, Hal.

Two specimens (♀ ♀) referable to this species, although one specimen is very small, only .62 mm. long. Collected from the marshes of Lake Hora Abjata, elevation about 5000 ft., 18. xi. 1926 (*J. Omer-Cooper*). Specimens deposited with British Museum (Moulton No. 2044).

Subfamily THIRIPINÆ, Karny.

ISOCHÆTOTHRIPS, gen. nov.

(*Physothrips seticollis*, Bagn., 1915, type of genus.)

Antennæ 8-segmented, spines on head and prothorax normal as in *Tæniothrips*, Uzel (without prominent spines on anterior angles of pronotum). Wings fully developed; both veins of fore wings with regularly placed spines as in *Frankliniella*, Karny.

Mr. R. S. Bagnall has described five species from Australia, namely, *Physothrips seticollis*, *P. setipennis*, *P. ignobilis*, *P. uniformis*, and *P. myrsiniicola*, in which both veins of the fore wings are regularly set with spines. This character is distinct from other members of the genus, *Tæniothrips* (or *Physothrips*), in which the fore vein of the fore wing has distinct intermissions between groups of spines. Mr. Bagnall has also indicated that these species are not congeneric with other members as we now recognize the genus *Tæniothrips*.

One African series collected by Dr. Hugh Scott includes seven ♀ specimens of another species which has many characters of the genus *Tæniothrips*, but with regularly

placed spines on both veins of the fore wings as in the genus *Frankliniella*. It is not congeneric with *Teniothrips*, and I am therefore erecting a new genus, *Isochatothrips*, to include it and naming *P. seticollis*, Bagn., as the type of the genus. The other species listed above should also be included in this genus.

2. *Isochatothrips scotti*, sp. n.

Female holotype.—Colour uniformly dark brown, except third antennal segment, which is yellow, slightly shaded with greyish brown in the middle. Fore tibiae yellow shaded brown at base and on the margins, middle and hind tibiae darker, yellowish at extreme tips, all tarsi yellow. Fore wings brown except for broad whitish bands in basal quarter, veins darker, hind wings whitish with a distinct longitudinal brown line beginning in basal fifth and fading just before tip. All body and wing spines dark brown. Crescents of ocelli orange-red.

Total body length 1.92 mm.; head length .166 mm., width .18 mm.; prothorax length .18 mm., width .25 mm.; mesothorax width .38 mm.; metathorax width .35 mm.; greatest width of abdomen .40 mm. Antennae: length (width) segment i. 24 μ (36); ii. 45 (30); iii. 90 (30); iv. 75 (24); v. 54 (21); vi. 75 (21); vii. 9; viii. 12 μ ; total length 375 μ . Spines on posterior angles of prothorax 105 μ long. Longest spines on ninth abdominal segment 180 μ , on tenth 141 μ .

Head approximately as long as wide, slightly constricted behind eyes; cheeks arched, vertex strongly cross-wrinkled near posterior margin; interocellar spines small, placed almost in front of posterior ocelli; a row of six or seven spines bordering the posterior margin of each eye, third from the outside being strongest, innermost on either side almost directly behind posterior ocelli. Eyes large, facets coarse, strongly pilose. Ocelli large, orange crescents prominent. Mouth-cone relatively short reaching two-thirds over prosternum, with blunt tip. Antennae one and two-thirds times as long as head, segments 7 and 8 very small, 8 only a little longer than 7, and together less than one-third as long as segment 6. Forked sense-cones on segments 3 and 4 and simple cones on segments 5 and 6 long and slender.

Prothorax almost one-third wider than long, with two prominent spines of equal length on each posterior angle, inward from these a series of three or four spines on either side along posterior margin, three outer ones small, fourth

and innermost ones prominent, $45\ \mu$ long. A series of five small anteriorly directed spines and several others directed backward on each anterior angle, but none of them conspicuously strong or prominent. A dark brown transverse line near posterior margin in front of marginal spines, with two or three other less prominent and broken lines immediately in front; otherwise no conspicuous lines or markings on pronotum. Mesonotum clearly transversely wrinkled and metanotum reticulate. Legs normal. Wings fully developed, with spines regularly placed over all veins, 39 on costa, 29 on fore vein, 19 on hind vein.

Eighth segment of abdomen with complete, though rather weak, comb arrangement of spines along posterior margin, tenth segment divided above. Variations in paratypes: spines on costa 29 to 39, on fore vein 19 to 29, hind vein 16 to 19. Tenth abdominal segment not clearly divided in one specimen.

Loc. Described from seven ♀ specimens taken at an elevation of about 9000 feet in the forest on Mt. Chhillalo, 12. xi. 1926 (*Hugh Scott*).

Holotype deposited with British Museum (Moulton No. 2043).

3. *Teniothrips abyssiniæ*, sp. n.

Female holotype.—Colour uniformly dark brown except third antennal segment and all tibiae and tarsi which are brownish yellow with tibiae shaded darker along upper and lower margins, especially near centre. Wings brown, each with a broad light band in basal fourth.

Total body length 1.5 mm.; head length .13 mm., width .15 mm.; prothorax length .13 mm., width .20 mm.; mesothorax width .28 mm.; metathorax width .25 mm.; greatest width of abdomen .28 mm. Spines on posterior angles of prothorax, outer $69\ \mu$, inner $87\ \mu$; along posterior margin of ninth abdominal segment, outer $120\ \mu$, inner $90\ \mu$; on tenth segment $105\ \mu$. Antennæ: length (width) segment iii. 60 (24); iv. 54 (24); v. 44 (21); vi. 60 (24); vii. 7; viii. $9\ \mu$.

Head with several more or less indistinct cross-wrinkles on vertex; cheeks strongly arched. Eyes and ocelli normal; interocellar spines small, placed in front of posterior ocelli. Antennæ relatively stout, with normal sense-cones, last two segments very small, almost equal in length and together about one-fourth as long as segment 6.

Pronotum with three spines on each side along posterior

margin inward from the long pairs on posterior angles, innermost of these is longest; numerous other small spines scattered over pronotum. Legs moderately slender. Wings fully developed reaching tip of abdomen. Spines on fore wings as follows: costa 31, fore vein with four and three in basal portion and four or five scattered in distal third, posterior vein with sixteen regularly placed spines.

Abdomen long and rather slender, comb-arrangement of spines on posterior margin of segment 8 complete but short and sparse; segment 10 divided above.

Loc. Described from two ♀ specimens taken "in forest" on Mt. Chillalo, at an elevation of about 9000 feet, 12. xi. 1926 (*Hugh Scott*).

Holotype deposited with British Museum (Moulton No. 2043).

This species is closely related to *inconsequens*, Uzel, and *ehrhorni*, Moulton, but distinguished from them as follows: from *inconsequens* by the lack of the fore tarsal tooth, inter-ocellar bristles placed above rather than between posterior ocelli, and a less apparent constriction behind the eyes; from *ehrhorni* in having uniformly dark brown antennæ with only third segment yellowish; *ehrhorni* has a light first segment, dark brown second, and the third and fourth are lighter at the base. *Ehrhorni* is also smaller and lighter in colour.

TUBULIFERA.

Family Phleothripidæ, Uzel.

4. *Phleothrips* (*Hoplandrothrips*) *cooperi*, sp. n.

Male holotype.—Colour dark brown with much red hypodermal pigmentation. Antennal segments 1, 2, 7, and 8 dark brown, 3 yellow, 4 yellow at base and tip and brown in the centre, 5 yellow in basal third, 6 dark brown but lighter at extreme base. Legs dark brown, only fore tibiæ yellow and shaded dark brown on upper and lower margins. Fore wings transparent, slightly greyish in the middle, hind wings transparent with a dark median longitudinal line. Body-spines transparent with dilated tips, short pointed spines on fore coxæ and on ninth abdominal segment dark brown.

Total body length 1·92 mm.; head length ·30 mm., width ·23 mm.; prothorax length ·166 mm., width (including prominent coxæ) ·40 mm.; mesothorax width ·43 mm.; metathorax width ·42 mm.; tube length ·166 mm., width at base ·066 mm.; fore femora length ·30 mm., width in basal

third .133 mm. Spines: postoculars $105\ \mu$; on anterior angles of prothorax $165\ \mu$, on posterior angles $90\ \mu$, mid-laterals $90\ \mu$, on prominent coxæ $72\ \mu$, long transparent spines on posterior angles of ninth abdominal segment $165\ \mu$; short stout spines $54\ \mu$; at end of tube $180\ \mu$. Antennal segments: length (width) i. 27 (36); ii. 45 (36); iii. 90 (45); iv. 96 (42); v. 81 (36); vi. 60 (33); vii. 51 (27); viii. 33; total length $483\ \mu$.

Head about one-third longer than wide; cheeks slightly arched, summit of head bearing the anterior ocellus prolonged in front and slightly overhanging basal segments of antennæ as in the genus *Leptothrips*. Warts on cheek small, large spines near back of head directed outwards and forwards, postoculars long and with dilated tips. Eyes normal. Posterior ocelli placed opposite anterior third of eyes. Mouth-cone pointed reaching to near posterior margin of prosternum. Antennal segment 3 with three large blunt-tipped sense-cones, 4 with four, 5 with two, 6 with two which are more slender, 7 with one. Spines of prothorax with dilated tips, those on anterior angles as long as prothorax and almost twice as long as spines on postocular angles. Fore femora greatly enlarged, each with two teeth at tip on the inside, ventral tooth much larger than dorsal one. Width of fore wing at about one-fourth its length from base $90\ \mu$, in the middle $66\ \mu$, and near the tip where the first double fringe-hairs are placed $69\ \mu$. There are fifteen and sixteen double fringe-hairs respectively on posterior margin of fore wings.

Abdomen is gradually reduced in size from the second segment. Long, transparent, blunt-tipped spines on segment 9 are about as long as tube.

Loc. Described from one ♂ specimen taken in Jem-Jem Forest, 8000–9000 feet, 25. ix. 1926 (*J. Omer-Cooper*).

Holotype deposited with the British Museum (Moulton No. 2033).

This species is most closely related to *P. (Hoplandrothrips) armiger*, Jones, but distinguished from the latter by its smaller size, shorter prothorax, which is .166 mm. as compared with .25 mm.; by the much longer antennæ, with segments 3 to 6 inclusive 93, 96, 87, and $63\ \mu$ as compared with 72, 72, 60, and $47\ \mu$ in *armiger*; by the transparent whitish spines on prothorax and two spines at base of the fore wing having dilated tips and one with a pointed tip; thoracic spines of *armiger* are dark, and all three at base of the fore wing have dilated tips; and by the darker-coloured middle and hind tarsi.

5. *Liothrips laingi*, sp. n.

Female holotype.—Colour: body blackish brown; antennæ: segment 1 concolorous with head, segment 2 likewise dark in basal half and extending to near tip on inner margin, light brown in outer half, this lighter colour extending below middle on outer side, segment 3 yellow with a slight brownish shading in distal half, segment 4 yellow shading to a little deeper brown in distal half, segment 5 yellow shading to a distinct brown in distal third, 6 yellow in basal half and rather abruptly brown in distal half, 7 and 8 brown. Prominent spines yellowish to light brown. Legs blackish brown, except extreme tips of tibiæ and tarsi, which are lighter. Wings transparent except for light yellowish-brown shading at base especially along anterior margin.

Total body length 3.8 mm.; head length .42 mm., width .23 mm.; prothorax length .25 mm., width .45 mm.; pterothorax width .55 mm.; tube length .33 mm., width at base .1 mm. Antennæ length (width) i. 36 (48); ii. 60 (44); iii. 156 (39); iv. 144 (42); v. 120 (36); vi. 90 (36); vii. 75 (30); viii. 39 μ ; total length 720 μ . Length of spines: postoculars 96 μ , on fore angles of prothorax 42 μ , along anterior margin and mid-laterals 60 μ , on posterior angles 185 μ , longest spines on ninth abdominal segment 255 μ , at tip of tube 225 μ .

Head almost twice as long as wide, apex prominent and swollen bearing the anterior ocellus; cheeks clearly constricted behind the eyes, gradually enlarging to past middle and almost parallel along posterior third; postocular spines long with blunt tips situated far back from eyes almost halfway between posterior margin of eyes and posterior margin of head. Eyes large, slightly protruding. Ocelli well developed. Mouth-cone sharply pointed, reaching to near posterior margin of prosternum. Antenna normal to genus; one sense-cone on outer distal margin of segment 3, three on 4, and two on 5 and 6.

Prothorax trapezoidal in shape; spines on anterior margin and angles short, mid-laterals somewhat longer, those on posterior angles very long. Spines on prominent coxæ about as long as those on anterior angles. Pterothorax large. Legs long and slender, fore femora slightly thickened, fore tarsi unarmed in both ♀ and ♂. A long prominent spine on inside near base of middle and hind femora and on outside near tip of middle and hind tibiæ. Wings fully developed, not constricted in the middle, with twenty to twenty-three double fringe-hairs.

Abdomen large, wing-holding spines prominent, other spines normal. Tube long and slender, almost three-fourths as long as head.

Male holotype.—Smaller, but coloured as in ♀.

Total body length 3·09 mm.; head length ·45 mm., width ·20 mm.; prothorax length ·20 mm., width (including prominent coxæ) ·38 mm.; pterothorax width ·53 mm.; tube length ·28 mm. Antennæ: length (width) i. 45 (45); ii. 60 (36); iii. 156 (35); iv. 150 (39); v. 120 (36); vi. 90 (33); vii. 66 (30); viii. 36 (18) μ ; total length 720 μ . Length of spines: postocular 108 μ , on anterior angles of prothorax 33 μ , on anterior margin 60 μ , mid-laterals 90 μ , on posterior angles 129–135 μ . Longest spines on ninth abdominal segment 300 μ , short spur-like spines 66 μ , at end of tube 225 μ .

Loc. Described from thirty-four ♀ and four ♂ specimens taken in Jem-Jem Forest, 8000–9000 feet, 21. ix. 1926 (*Hugh Scott*). Host-plant unknown.

Types deposited with British Museum (Moulton Nos. 2027, 2029, 2031).

This species is distinguished from *L. africanus*, Vuil., by the differently shaped head; the greater length of antennal segments 3, 4, and 5, these being 156, 144, and 120 μ as compared with 119, 108, 95 μ in *L. africanus*; by the longer tube ·33 mm., as compared with ·23 mm., and by the position of the postocular spines. Vuillet's figure shows them close behind the eyes in *africanus*, while in *L. laingi* they are placed about midway between the posterior margin of eyes and posterior margin of head. The two species are very similar in colour, except perhaps a more distinct shading of brown in antennal segments 3, 4, and 5 of this new species.

I take pleasure in naming this species after Mr. Frederick Laing, who has kindly forwarded these specimens to me for study and identification.

6. *Liothrips nigripes*, sp. n.

Female holotype.—Colour blackish brown; antennæ: segments 1 and 2 concolorous with head, 2 shading lighter toward tip, 3 light yellowish brown in basal half gradually shading darker in distal half, 4 and 5 yellowish brown each gradually shading darker toward outer half, and 5 darker than 4, 6 light brown at tip, 7 and 8 blackish brown. Legs, including all tarsi, blackish brown. Wings transparent. Prominent spines dark brown.

Total body length 2·92 mm.; head length ·40 mm., width

·22 mm.; prothorax length ·22 mm., width ·38 mm.; pterothorax width ·48 mm.; tube ·22 mm. Antenna: length i. 36; ii. 60; iii. 135; iv. 120; v. 87 μ ; vi., vii., and viii. not in position to measure accurately. Length of spines: postoculars 36 μ ; on anterior margin of prothorax 50 μ , on anterior angles 42 μ , mid-laterals 66 μ , on posterior angles 116 μ ; longest spines on ninth abdominal segment 180 μ , at tip of tube 200 μ . All prominent spines with blunt tips.

This species is very closely related to and has the general appearance of *L. laingi*, M., but may be distinguished as follows: antennæ: segments 3, 4, and 5 are respectively 135, 120, and 87 μ , as compared with 156, 144, and 120 μ in *laingi* and segments 4, 5, and 6 are more distinctly brown in colour. Sides of head are almost parallel, swollen apex is hardly noticeable, while in *laingi* it is very prominent. Postocular bristles are much shorter, 36 μ as compared with 96 μ in *laingi*, and are placed closer behind the eyes, at about one-third the distance between posterior margin of eyes and posterior margin of head. Tube is ·22 mm. as compared with ·33 mm. in *laingi*. There are nineteen to twenty-three double fringe-hairs on fore wings. Fore tarsi unarmed.

Loc. Described from one ♀ specimen taken in Jem-Jem Forest, 8000–9000 feet, 21. ix. 1926 (*Hugh Scott*).

This *holotype* specimen, unfortunately somewhat broken, is deposited with the British Museum (Moulton No. 2029).

7. *Liothrips flavipes*, sp. n.

Female holotype.—Colour: body blackish brown; antenna: segment 1 concolorous with head, 2 dark brown, only a shade lighter than segment 1, 3, 4, 5, basal two-thirds of 6 and basal one-half of 7 yellow, distal third of 6 greyish brown, distal half of 7 and 8 darker grey-brown. Legs, fore femora, except at extreme tips, middle and hind femora, and middle and hind tibiæ, except at tips, blackish brown. Fore tibiæ, middle and hind tibiæ at extreme tips, and all tarsi yellow. Wings greyish brown, somewhat lighter at base, darker along outer margins, each with a conspicuous dark longitudinal band extending throughout the centre of wing from near base, which gradually becomes diffused with the rather uniformly brownish-grey tips. All prominent spines brown to dark brown except those on ninth abdominal segment which are yellowish.

Total body length 1·96 mm., head length ·3 mm., width ·25 mm.; prothorax length ·20 mm., width (including coxæ)

·35 mm. ; mesothorax width ·43 mm. ; tube length ·23 mm. Antennæ: length (width) i. 30 (44) ; ii. 54 (36) ; iii. 90 (30) ; iv. 84 (33) ; v. 84 (30) ; vi. 84 (30) ; vii. 66 (24) ; viii. 44 μ ; total length 540 μ . Length of spines: postoculars 30 μ (?) ; on anterior margin of prothorax 60 μ , on anterior angles extremely small, mid-laterals 90 μ , on posterior angles 114 μ , longest spines on ninth abdominal segment 150 μ , at end of tube 225 μ .

Head evenly shaped, about one and one-fourth times as long as wide, apex swollen and protruding, cheeks straight and almost parallel ; eyes large, not protruding ; postocular spines very small with blunt tips, located rather close behind eyes. Ocelli large. Mouth-cone sharply pointed, reaching posterior margin of prosternum. Antennæ slender ; sense-cones long, slender and with pointed tips, segment iii. 1 ; iv. 3 + 1 ; v. 2 + 1 ; vi. 1 + 1 ; vii. 1.

Prothorax strongly transverse ; spines on anterior angles very small, almost vestigial, on anterior margin well developed, those on posterior angles and the mid-laterals strong. All prominent spines with blunt tips. Mesothorax largest. Legs slender, fore femora slightly thickened, fore-tarsal claw hook-shaped. Hind tarsi with a distinct fine comb-like arrangement of about ten teeth. Wings fully developed, sides parallel, with fifteen to seventeen double fringe-hairs. Abdomen broad, tube slender, three-fourths as long as head.

Loc. Described from one ♀ specimen taken in Jem-Jem Forest, 8000–9000 feet, 21. ix. 1926 (*Hugh Scott*). Host-plant not known.

Holotype deposited with British Museum (Moulton No. 2029).

This species is very similar to *L. brevicollis*, Bagnall, *hradecensis*, Uzel, and *setinodis*, Reuter., but distinguished as follows: *L. flavipes* has brown-coloured wings, especially along margins, and with a darker median longitudinal line or cloud, and the seventh antennal segment is yellow in basal half. *L. brevicollis* has transparent wings and *setinodis* has clear fore wings clouded only at base ; both have a uniformly dark seventh antennal segment. *Hradecensis* has second antennal segment yellow at tip and seventh segment grey-brown ; wings clear with a brownish-grey longitudinal stripe.

8. *Haplothrips gowdeyi*, Frank.

One ♂ and two ♀ specimens collected by sweeping "Maskal" flowers—that is, wild Compositæ of the genera

Guizotia and *Coreopsis*—in the Jem-Jem Forest, at an elevation between 8000 and 9000 feet, 23. ix. 1926 (*J. Omer-Cooper*), may be assigned to this species with the following notation: Female specimens are typical, but antennal segments 3 to 6 inclusive in the male are much darker than in the female, 3 being brown, 4 and 5 a little darker, and 6 uniformly darker brown like 7 and 8.

9. *Haplothrips cooperi*, sp. n.

Female holotype.—Colour blackish brown except antennal segments 3 to 6, which are yellow, and segments 7 and 8 brown. Fore tibiae dark brown in basal half, gradually shading to yellowish brown at tips, all tarsi brownish yellow; wings clear.

Total body length 1·6 mm.; head length ·20 mm., width ·166 mm.; prothorax length ·133 mm., width ·23 mm.; mesothorax width ·266 mm.; tube length ·12 mm. Antennae length (width): i. 21; ii. 45 (27); iii. 42 (27); iv. 48 (30); v. 42 (27); vi. 42 (24); vii. 36 (21); viii. 24 μ ; total length 300 μ . Length of spines: postoculars 51, on anterior angles of prothorax 33, mid-laterals 30, on posterior angles 75 μ .

Head approximately one-fifth longer than wide; cheeks very slightly arched; apex somewhat swollen and bearing prominent anterior ocellus which does not overhang bases of antennae; postocular spines well developed, extending beyond sides of head, transparent with blunt tips. Eyes relatively large. Ocelli large, contiguous with inner anterior margin of eyes. Mouth-cone short, rounded, extending past middle of prosternum. Antennae less than one and one-half times as long as head; segment 3 small, about one and one-half times as long as wide; without sense-cones on inner margin; segment 4 largest, segments 5 and 6 subequal to 3.

Prothorax ·6 as long as head. Legs normal, fore femora somewhat thickened, fore tarsus armed with a minute tooth. Wings narrowed in the middle, the three prominent spines at base with rounded or dilated tips, with five to seven double fringe-hairs. Abdomen normal, tube short, approximately ·4 shorter than head and rather stout.

Male allotype.—A little smaller than female, similar in colour except that antennal segments 3 to 6 are sometimes shaded greyish brown on dorsal sides and fore femora are somewhat more enlarged. Dorsal spur-like spines on posterior margin of ninth abdominal segment are rather stout and brown.

Loc. Described from fourteen ♀ and seven ♂ specimens taken in the marshes of Lake Hora Abjata, ca. 5000 feet, 18. xi. 26 (*J. Omer-Cooper*).

Holotype, allotype, and eighteen paratypes deposited with British Museum (Moulton No. 2044).

This species has the general colour and appearance of *H. kourdjumovi*, Karny, but may be distinguished from it by its shorter third antennal segment and the middle and hind tibiae are uniformly dark without any light colouring at extreme tips. From *H. gowdeyi*, Frankl., it may be distinguished by the absence of a sense-cone on the inside of third antennal segment. I take pleasure in naming the species after the collector.

10. *Haplothrips wouramboulchii*, sp. n.

Female holotype.—Colour blackish brown with reddish body-pigment conspicuous; antennal segment 3 shaded on dorsal and ventral side, but lighter in the middle when viewed from the side; fore tibiae and fore tarsi a shade lighter. Wings transparent with extreme base, including scale, dark brown. All prominent body-spines transparent or only slightly yellowish except the curved wing holding spines which are dark brown.

Total body length 2.75 mm.; head length 2.66 mm., width .20 mm.; prothorax length .183 mm., width .35 mm.; pterothorax width .45 mm.; tube length .20 mm., width at base .066 mm., at tip .04 mm. Antennae: length (width) i. 30; ii. 45 (33); iii. 54 (33); iv. 60 (38); v. 60 (33); vi. 54 (27); vii. 51 (21); viii. 33; total length 375 μ . Length of spines: postoculars 84 μ , on posterior angles of prothorax 135 μ . Basal wing-spines 90, 135, and 129 μ respectively, on ninth abdominal segment 129 μ ; at tip of tube 150 μ .

Head approximately one-fifth longer than wide; cheeks slightly arched; postocular spines long, slender, and pointed, about one-third the length of the head. Eyes large. Ocelli placed far forward. Mouth-cone very short and rounded, reaching only to near middle of prosternum. Antenna less than one and one-third times as long as head; sense-cones very short, pointed and transparent, segment 3 with a sense-cone on inner side.

Prothorax with all spines vestigial, except a single long and pointed one on each posterior angle. Pterothorax with sides slightly arched. Legs slender, fore femora somewhat thickened, each fore tarsus with a minute tooth. Wings fully developed, conspicuously narrowed in the middle without

double fringe-hairs. Three basal spines long, pointed, and arranged in an almost straight line. Abdomen normal. Tube long and slender $\cdot 8$ as long as head.

Male allotype.—Similar in colour to female.

Total body length 2.08 mm.; head length $\cdot 233$ mm., width $\cdot 18$ mm.; prothorax length $\cdot 166$ mm., width $\cdot 32$ mm.; pterothorax width $\cdot 40$ mm.; tube length $\cdot 20$ mm. Antennæ: length (width) i. 30; ii. 48 (30); iii. 57 (30); iv. 57 (33); v. 57 (30); vi. 48 (24); vii. 48 (18); viii. 36μ ; total length 381μ . Length of spines: postoculars 84, on posterior angles of prothorax 185μ , basal wing-spines subequal 90μ ; on ninth abdominal segment 135μ , at end of tube 150μ . Tube $\cdot 9$ as long as head.

Loc. Described from twenty-four ♀ and ten ♂ specimens, taken near Wouramboulchi*, ca. 9000 feet, 30. ix. 1926 (*J. Omer-Cooper*), and named after the type-locality. Host-plant unknown.

Holotype, allotype, and paratypes deposited with British Museum (Moulton No. 2034).

This species is closely related to *bagnalli*, Trybom, *brevicauda*, Trybom, and *unicolor*, Bagnall. All of these species are rather large and are especially characterized by the absence of double fringe-hairs on the wings. *H. wouramboulchii* is perhaps most closely related to *bagnalli* and is separated by the longer tube. In *bagnalli* the tube is not over $\cdot 7$ as long as head, while in this new species in the female it is at least $\cdot 8$, and in the male approximately $\cdot 9$ as long as head. *H. brevicauda* has a still shorter tube. *H. unicolor* has blunt spines and the wing-fringe is sparse, while in this species the body-spines are long and pointed and the fringe-hairs of the wings are closely placed.

11. *Haplothrips biformis*, sp. n.

Female holotype.—Colour blackish brown; segment 3 of antenna in dorsal view light brown at the base shading to dark brown at tip; viewed from the side, shaded darker on dorsal and ventral sides, lighter in the middle or in paratypes distinctly lighter; fore tibiae and fore tarsi somewhat lighter. Wings uniformly light yellowish grey with bases, especially the scale, darkened. Prominent spines brown.

Total body length 2.6 mm.; head length $\cdot 23$ mm., width $\cdot 20$ mm.; prothorax length $\cdot 18$ mm., width $\cdot 33$ mm.; pterothorax width $\cdot 45$ mm.; tube length $\cdot 22$ mm., width at base $\cdot 078$ mm., at tip $\cdot 045$ mm. Fore femora length $\cdot 183$ mm., width $\cdot 09$ mm. Wing length 1.42 mm., width $\cdot 183$ mm., in

* [Wouramboulchi lies beyond Jem-Jem Forest, roughly 50 miles nearly due west to Addis Ababa.—HUGH SCOTT.]

middle .083 mm., near tip .133 mm. Antennæ: length (width) i. 30 (36); ii. 54 (33); iii. 60 (33); iv. 66 (33); v. 66 (30); vi. 54 (24); vii. 51 (21); viii. 36; total length 405 μ . Length of spines: postoculars 60, on posterior angles of prothorax 81, basal wing-spines 57, 75, 90 μ respectively, on ninth abdominal segment 135 μ .

Head .1 longer than wide; cheeks almost parallel, only slightly constricted behind; postocular spines well developed, pointed, cheek-spines present but sparse. Eyes distinctly protruding in front. Ocelli normal. Mouth-cone short, broadly rounded, extending to near middle of prosternum. Antenna 1.7 times as long as head; sense-cones very short, sharply pointed, transparent, segment 3 with a sense-cone on inner side.

Prothorax with a pair of prominent spines only on posterior angles, other spines vestigial, except in a few paratypes where the spines on anterior angles are developed sometimes to a length of 30 μ . Mesothorax with sides arched, metathorax with sides converging posteriorly. Legs normal, fore femora somewhat thickened, fore tarsi each with a minute tooth. Wings fully developed, broad, narrowed in the middle with seven to nine double fringe-hairs; three basal spines closely placed in a broadly triangular position. Abdomen large, broad, gradually tapering from the third segment toward the end. Tube long and narrow about .2 shorter than head and approximately one-third broader at base than at tip.

Male allotype (form *œdymmer*).—Colour as in the female, except that the fore tibiæ are strongly shaded on upper and lower margins and brownish yellow in the middle.

Total body length 2.42 mm.; head length .25 mm., width .20 mm.; prothorax length .20 mm., width .38 mm.; pterothorax width .41 mm.; tube length .20 mm.; length of fore femora .316 mm., width .133 mm.; wing length 1.26 mm., width near base .15 mm., in the middle .08 mm., near tip .133 mm. Antennæ: length (width) i. 30 (36); ii. 45 (30); iii. 60 (30); iv. 63 (33); v. 60 (28); vi. 51 (24); vii. 48 (21); viii. 30; total length 390 μ . Length of spines: postoculars 87 μ , on posterior angles of prothorax 75 (?); basal wing-spines 60, 75, and 75 respectively; on ninth abdominal segment inner 150, spurs 39, outer 165 μ .

Male paratype (form *gynäcoïd*).—Colour as in the *œdymmer* form of male, except that the fore tibiæ gradually shade from dark brown at base to brown at tip, and the third antennal segment is more uniformly brown.

Total body length 2.16 mm. (body slightly distended); head length .22 mm., width .166 mm.; prothorax length

·15 mm., width ·266 mm.; pterothorax width ·366 mm.; tube length ·183 mm.; fore femora length ·166 mm., width ·07 mm.; wing length 1·16 mm.; width near base ·133 mm., width at middle ·066 mm., near tip ·10 mm. Antennæ: length (width) i. 24; ii. 45 (30); iii. 54 (27); iv. 60 (30); v. 54 (27); vi. 45 (21); vii. 45 (18); viii. 30; total length 345 μ . Length of spines: postoculars 60 μ , on posterior angles of prothorax 60 μ , basal wing-spines 36, 63, 75, on ninth abdominal segment inner 90, spurs 36, outer 126 μ .

This species is closely related to *H. nigricornis*, Bagnall, and *H. simplex*, Buffa. The specimens examined show considerable variations in the shading of the third antennal segment and the fore tibiæ, this variation is especially noticeable when the antennæ or legs are viewed from the side rather than dorsally. The two male forms, however, offer the most conspicuous variation. The cœdymer form has an enlarged prothorax, extremely large fore femora, and the wings are strong and broad as in the female. The gynæcoid form has a much smaller prothorax, slender fore femora, and the wings, though fully developed, are narrower.

Loc. Described from numerous ♀ and ♂ specimens. Cœdymer form with enlarged thorax and fore legs and gynæcoid with normal thorax and fore legs. Taken in the Jem-Jem Forest, 8000–9000 feet, by sweeping "Maskal" flowers (wild Compositæ, genera *Guizotia* and *Coreopsis*), on 22. ix. 1926 (*J. Omer-Cooper*).

Holotype, allotype, and numerous paratypes deposited with the British Museum (Moulton No. 2030, 2031–2033, 2036, 2038, and 2039).

12. *Haplothrips æthiopæ*, sp. n.

Female holotype.—Colour blackish brown, third antennal segment almost uniformly blackish brown, only very slightly lighter at base, tips of fore tibiæ and fore tarsi a shade lighter. Wings with slight yellowish-grey shading, almost transparent. Prominent body-spines brown.

Total body length 2·92 mm.; head length ·30 mm., width ·22 mm.; prothorax length ·19 mm., width ·40 mm.; pterothorax width ·50 mm.; tube length ·25 mm., width at base ·08 mm., at tip ·05 mm. Antennæ: length (width) i. 33; ii. 54 (36); iii. 75 (39); iv. 72 (42); v. 66 (39); vi. 63 (36); vii. 63 (24); viii. 39 μ ; total length 480 μ . Length of spines: postoculars 120 μ , on anterior angles of prothorax 39 μ , mid-laterals 60 μ , on posterior angles 120 μ , on ninth abdominal segment 150 μ , basal wing-spines 99, 108, and 120 μ respectively.

Head $\cdot 45$ longer than wide; cheeks slightly arched, constricted posteriorly; postocular spines long, slightly curved with blunt tips; several brown cheek-spines present on each side. Eyes large, slightly protruding in front, extending farther back on dorsal side than on ventral side. Antenna $1\cdot 6$ times as long as head: sense-cones short, pointed, segment 3 with sense-cones on inner side.

Prothorax with all prominent spines developed, pterothorax with sides evenly arched. Legs normal. Fore tarsus with a minute tooth. Wings fully developed, broad, narrowed in the middle with eight double fringe-hairs; three basal wing-spines long, slightly curved with blunt tips. Abdomen large; tube slender, $\cdot 83$ mm. times as long as head.

Male allotype.—Colour as in the female with fore tibiae at the tip and fore tarsi lighter.

Total body length $2\cdot 46$ m.; head length $\cdot 25$ mm., width $\cdot 215$ mm.; prothorax length $\cdot 183$ mm., width $\cdot 140$ mm.; pterothorax width $\cdot 466$ mm.; tube-length $\cdot 23$ mm., width at base $\cdot 066$ mm., at tip $\cdot 05$ mm. Antennae: length (width) i. 36 ; ii. 48 (39); iii. 63 (36); iv. 72 (36); v. 66 (36); vi. 66 (38); vii. 66 (20); viii. 42 ; total length $450\ \mu$. Length of spines: postoculars $120\ \mu$, on anterior margin of prothorax $39\ \mu$, mid-laterals $60\ \mu$, on posterior angles $120\ \mu$. Wing-spines 81 , 105 , and $105\ \mu$ respectively, on ninth abdominal segment 195 , spurs 51 , at tip of tube $180\ \mu$.

Loc. Described from three ♀ and two ♂ specimens taken in the marshes of Wouramboulchi, near Jem-Jem*, ca. 9000 feet, 5. x. 1926 (*J. Omer-Cooper*).

Holotype and *allotype* deposited in the British Museum (Moulton No. 2035).

13. *Watsoniella flavipes*, sp. n.

Female holotype.—Colour blackish brown except fore tibiae and all tarsi which are brownish yellow. and antennal segments 3 to 6 which are yellow. Wings transparent.

Total body length $1\cdot 92$ mm. (abdomen distended); head length $\cdot 26$ mm., width $\cdot 15$ mm.; prothorax length $\cdot 12$ mm., width $\cdot 23$ mm. (including prominent coxae); pterothorax width $\cdot 25$ mm.; tube length $\cdot 15$ mm. Antennae: length (width) i. (30); ii. 45 (30); iii. 54 (30); iv. 60 (30); v. 60 (27); vi. 39 (24); vii. 36 (21); viii. $27\ \mu$; total length $336\ \mu$. Length of spines: postoculars $36\ \mu$; on anterior angles of prothorax $21\ \mu$; mid-laterals $21\ \mu$; on posterior angles $48\ \mu$.

* See footnote on p. 238.

Head almost twice as long as wide, apex of head not swollen; cheeks almost straight and parallel; postocular spines arising immediately behind lower angles of eyes, short with dilated tips. Eyes elongate, not protruding. Ocelli moderately small, anterior ocellus directed forward, but not prominent. Mouth-cone short, reaching two-thirds over prosternum, labrum narrowed toward the tip. Antennæ about one and one-fourth times as long as head, sense-cones normal, two on segment 3 and three on segment 4.

Prothorax only slightly wider than head. Pterothorax also slightly wider than prothorax. Abdomen long and narrow. Tube .6 as long as head. Legs comparatively short and slender, unarmed. Wings fully developed. Fore wings slightly narrowed in the middle and slender from middle to tip. No double fringe-hairs.

Loc. Described from three ♀ specimens taken in the marshes of Lake Hora Abjata, ca. 5000 feet, 18. xi. 1926 (*J. Omer-Cooper*).

Holotype and one allotype deposited with the British Museum (Moulton No. 2044).

This species appears most nearly related to *Watsoniella elongata*, Watson (Karny), in shape, size, and markings, but may be separated by its dark brown colouring, except antennal segments 3 to 6 which are yellow, and fore tibiæ and all tarsi which are brownish yellow. *W. elongata* has the head, thorax, and tube dark reddish brown, antennal segments 2 to 5, fore tibiæ, middle and hind legs, and abdomen yellowish brown.

14. *Watsoniella brevituba*, sp. n.

Female holotype.—Colour blackish brown including all legs and antennæ, except segment 3 which is yellow at base gradually shading to light brown at tip, and segment 4 which is light brown at base gradually shading to dark brown in outer third. Wings slightly greyish, brown at extreme base.

Total body length 3.25 mm.; head length .4 mm., width .2 mm.; prothorax length .18 mm., width .30 mm. (including coxæ .35 mm.); pterothorax width .53 mm. (somewhat pressed out); tube length .20 mm., width at base .10 mm. Antennæ: length (width) i. 45 (39); ii. 60 (42); iii. 120 (36); iv. 111 (42); v. 90 (36); vi. 75 (36); vii. 60 (33); viii. 36; total length 630 μ .

Head twice as long as wide; cheeks straight and parallel, constricted only slightly at base, apex not swollen; postocular spines very small, located immediately behind eyes. Eyes

large, slightly protruding. Ocelli well developed. Mouth-cone short, reaching about halfway across prosternum, broadly rounded, labrum narrowed toward tip. Antennæ 1.5 times as long as head; segment 2 with two sense-cones, 3 with three, 4 with 2 + 1.

Prothorax small; all spines vestigial except a pair on each posterior angle, the outer with a blunt tip, 54 μ long, inner 83 μ . Pterothorax largest. Legs long and slender, unarmed. Wings fully developed, clearly narrowed in the middle, ten double fringe-hairs. Abdomen long and narrow. Tube short and broad, one-half as long as head. Longest spines on segment 9 180 μ , on tube 200 μ .

Loc. Described from two ♀ specimens taken in Jem-Jem Forest, 8000-9000 feet, 25. ix. 1926 (*J. Omer-Cooper*).

Holotype deposited in British Museum (Moulton No. 2033).

This species can be separated from *W. flavipes* by its much larger size, darker legs and antennæ, more clearly constricted wings, and bearing ten double fringe-hairs. Third segment of antenna is clearly elongate, while in *W. flavipes* it is pear-shaped.

Elaphrothrips (Dicaiothrips), Buffa.

Mr. J. D. Hood in a recent publication has placed the genus *Dicaiothrips*, Buffa, as a synonym of *Elaphrothrips*, Buffa (Hood, March 1927, 'Entomologica Americana,' vol. ii. (new series), no. 4, p. 239).

A study of many specimens belonging to this genus reveals a second pair of long spines behind the postoculars on vertex of head. The length of these spines varies, and they may be placed rather closely behind the postoculars or much farther back.

15. *Elaphrothrips falcatus*, Karny.

The wings, and also the second pair of dorsal head-spines, have been broken off of the single specimen which I am here identifying as *E. falcatus*, Karny, but the pits of the spines are clear and are placed midway between the posterior margin of eyes and the posterior margin of head. This specimen is very similar to my types from India except that the tube is somewhat broader at the base.

Loc. Jem-Jem Forest, 8000-9000 feet, 21. ix. 1926 (*Hugh Scott*).

16. *Elaphrothrips oculatus*, sp. n.

Female holotype.—Colour blackish brown except third antennal segment, which is brownish yellow shaded brown at the tip. Wings transparent.

Total body length 4 mm.; head length .60 mm., width at eyes .26 mm., width near posterior margin .30 mm.; summit length .083 mm., width .150 mm.; prothorax length .266 mm., width (including prominent coxæ) .65 mm.; pterothorax width .75 mm.; length of seventh abdominal segment .20 mm., eighth .16 mm., ninth .13 mm., tube length .55 mm., width at base .18 mm., at tip .08 mm. Antennæ: length (width) ii. 81 (48); iii. 240 (48); iv. 201 (48); v. 150 (45); vi. 114 (36); vii. 75 (30); viii. 81; total length 1 mm. Spines mostly broken off. Eyes length .12, width .075 mm.

Head slightly more than twice as long as wide. There is a distinct emargination between eyes and cheeks on either side, then a swelling about one-fourth as long as the eye; following this the cheeks are narrowed and thence gradually swollen and then slightly constricted at base. Genal spines are short and stout with blunt tips. Unfortunately, the long ante-ocellar and postocular spines have been broken off of the single specimens before me, but the pits are present, and those for the postoculars are placed about midway between posterior margin of eyes and posterior margin of head. Outer margin of each eye shows a distinct constriction about one-fifth the eye's length from its posterior margin, so that its outer margin is not even in outline. Ocelli relatively small. Mouth-cone short, triangular in outline, reaching halfway across prosternum. Antennæ one and two-thirds times as long as head, the two short stout spines on dorsal side near end of segment 2 have blunt tips.

Prothorax, including prominent coxæ, trapezoidal in outline, .45 times as long as head. Mid-lateral and posterior angular spines broken away, but their pits are in normal position. Pterothorax with sides almost parallel. Legs long and slender, except fore femora which are much enlarged. Each fore tarsus armed with a small triangular tooth about as long as breadth at base. Wings transparent with twenty-eight to twenty-nine double fringe-hairs.

Abdomen wider than pterothorax; segments 2 to 5 of about even width, the following gradually narrowed. Tube rather slender, eleven-twelfths as long as head. Most of the thoracic and body bristles are broken off of the single specimen before me.

Loc. Described from one ♀ specimen taken in the Lagalafto Ravine, between the Hawash River and Lake Zwai, ca. 6000 feet, 31. x. 1926 (*Hugh Scott*).

Holotype in British Museum (Moulton No. 2042).

This species is closely related to *E. seychellensis*, Bagnall, in which the antenna is 1.5 times as long as head, head 2.6 times as long as wide, tube .8 as long as head, genal spines

knobbed and colourless, fore tarsal tooth short and broadly seated. *E. oculatus* has antennæ 1·7 times as long as head, head twice as long as wide, tube ·9 head's length, genal spines almost black, and fore tarsal tooth rather sharp and well defined.

17. *Elaphrothrips genaspinosus*, sp. n.

Female holotype.—Colour blackish brown including all legs and antennal segments 1, 2, 6, 7, and 8, segment 2 lighter brown in distal third, 3 yellow with a ring of brown at extreme tip, 4 brownish yellow clouded brown at tip, 5 brownish yellow in basal two-thirds, rather abruptly blackish brown in distal third. Genal spines dark brown, other prominent body-spines yellow. Wings transparent.

Total body length 4·13 mm.; head length ·72 mm., width across eyes ·266 mm., across narrowed portion behind eyes ·225 mm., near posterior margin ·25 mm. Length of head-projection in front of eyes ·066 mm., width ·15 mm.; prothorax length ·266 mm., width (including prominent coxæ) ·6 mm.; width of pterothorax ·78 mm.; width of third abdominal segment ·88 mm.; length of seventh abdominal segment ·22 mm.; eighth ·19 mm.; ninth ·15 mm. Tube length ·58 mm., width at base ·15 mm. Length of spines: ante-oculars 166 μ , on prominent coxæ 83 μ , on ninth abdominal segment 600 μ . Antennæ: length (width) i. 54 (60); ii. 81 (48); iii. 255 (48); iv. 204 (51); v. 165 (45); vi. 111 (65); total length 960 μ .

Head 2·8 times as long as wide, broadest across eyes, distinctly narrowed behind the eyes; cheeks very slightly swollen back of middle and slightly constricted at base. Length of anterior projection ·44 its width. Ante-ocular spines long, postocular spines broken off in holotype, second pair of dorsal head-spines small and placed about midway between posterior margin of eyes and posterior margin of head, seven or eight short stout genal spines on either side. Eyes large, clearly protruding. Ocelli well developed. Mouth-cone short, reaching only halfway across prosternum. Antennæ one and one-third times length of head, third segment noticeably long and slender, three times as long as 2, slightly more than five times as long as greatest width, segment 4 about one-fifth shorter than 3; two sense-cones on each of segments 3 and 4 rather slender and slightly curved.

Prothorax trapezoidal in shape, with sides evenly diverging to junction of coxæ. Pterothorax with sides rather evenly arched. Legs long and slender, fore femora thickened, fore tarsal tooth small and broadly seated. Outer margin of fore femora with about fourteen stout spines of various sizes.

Wings well developed, with thirty-seven double fringe-hairs. Abdominal segments 3 and 4 broadest, others gradually reduced toward tip. Tube narrow .82 times length of head. Abdominal spines long and transparent, those on segment 9 as long as tube.

Male allotype, No. 2028.—Similar in colour to ♀.

Total body length 3.83 mm.; head length .68 mm.; width at eyes .26 mm., at constriction behind eyes .20 mm., near posterior margin .23 mm. Prothorax length .266 mm., width (including prominent coxæ) .55 mm.; pterothorax width .62 mm., abdominal segment 2 .65 mm., length of seventh abdominal segment .22 mm.; eighth .20 mm.; ninth abdominal segment .12 mm. Tube length .45 mm. Antennæ: length (width) i. 66 (66); ii. 99 (45); iii. 270 (48); iv. 210 (45); v. 180 (42); vi. 90 (36); vii. 81 (33); viii. 78 (27); total length 1074 μ .

Similar in shape to female, with fore femora larger and genal spines and those along outer margin of fore femora stronger, with three especially stout ones near basal end and a strong sickle-shaped one near tip. Tarsal tooth long and pointed. Abdominal segments gradually decreasing in size from second segment. Wings with thirty-nine double fringe-hairs.

Loc. Described from four ♀ and three ♂ specimens taken by sweeping various plants and from under bark in a ravine at Wachacha, near Addis Ababa, ca. 8000 feet, 9. ix. 1926, also near Addis Alam, 19. ix. 1926 (*Hugh Scott*).

Types are deposited in the British Museum (Moulton Nos. 2027, 2028, 2029, 2032, 2040).

This species may be separated from *E. stenocephalus*, Bagnall, by its shorter head, being 2.8 times as long as broad as compared with 3.3 times in *stenocephalus*, Bagnall, the longer tube, .8 length of head as compared with .68, its somewhat smaller size, 4.1 mm. as compared with 4.7 mm., and the slightly different colour of antennæ. It may be separated from *E. mabirensis*, Priesner, by the yellowish basal two-thirds of fifth antennal segment which is brown in the latter, and the longer third, fourth, and fifth antennal segments, 255, 205, and 165 μ as compared with 200, 182, and 170 μ in the latter.

Measurements of one ♀ paratype (No. 2029) and two ♂ ♂ (2038 and 2040) are as follows:—

Total body length.	Antennal segments			Wings d. f. h.
	3	4	5	
2029, ♀, 5 mm.	270	219	150 m.	39
2028, ♂, 4.5 mm. ..	270	210	174 m.	40
2040, ♂, 4.5 mm. ..	270	228	189 m.	40

The fore femora of these two ♂♂ are greatly enlarged and fore tarsal tooth longer and stronger. The dark brown colouring of antennal segments 3, 4, and 5 is more abruptly contrasted than in the allotype. Also the fore tibiae are yellowish brown in the median distal portion, but dark on the edges. However, I am unwilling to set these apart as a separate variety, although they appear quite distinct from the allotype.

18. *Idolothrips niger*, sp. n.

Holotype.—Blackish brown except extreme tips of all tibiae and all tarsi, which are dark brown; antennal segment 1 concolorous with head, 2 blackish in basal half shading to yellow in outer third, 3 yellow shaded light brown at extreme tip, 4 and 5 brownish yellow shaded brown at tips, 6 light brown in basal half, outer half and 7 and 8 blackish brown. Wings uniformly light smoky brown.

Total body length 7.3 mm. Head length .8 mm., greatest width .33 mm.; prothorax length .35 mm., width (including prominent coxae) .66 mm.; pterothorax width .95 mm. Length of seventh abdominal segment .55 mm., eighth .45 mm., ninth .23 mm.; tube 1.33 mm. Antennae: length i. 75; ii. 75; iii. 460; iv. 350; v. 200; vi. 120; vii. 80; viii. 66 μ ; total 1.386 mm.

Head almost three times as long as wide, apex only slightly produced beyond eyes; cheeks narrowed behind the eyes and then gradually diverging to near base where they are again rather abruptly constricted. Surface of head covered with numerous short, stout, black spines, postoculars not distinguished from the others. A small but distinct spine behind each posterior ocellus. Eyes large, distinctly protruding, semi-kidney shaped. Ocelli well developed, posterior ocelli placed in the concave inner margins of the eyes. Mouth-cone short, rounded. Antennae with greatly elongated third segment; one long sense-cone (96 μ) on outer side near end of segment 3, 2+1 on segments 4, 5, and 6.

Prothorax less than one-half as long as head and much narrower than pterothorax; spines on posterior angles short (60 μ), black. Pterothorax largest of body-segments. Legs long and slender, each fore tarsus armed with a small tooth. Wings fully developed, with forty-three double fringe-hairs.

Abdomen long and slender with two short slightly curved stout black spines on each posterior angle of segments 8 to 9, those on 9 longest, 150 μ , and almost straight. Tube long and slender, 1.6 times as long as head.

Loc. Described from one specimen, sex not determined,

but probably a ♂, taken in Jem-Jem Forest, 8000–9000 feet, 21. ix. 1926 (Hugh Scott).

Holotype in British Museum.

This species resembles *I. nigrodentatus*, Karny, but may be separated from it by the blackish colour of the legs. The fore tibiae and central portions of middle and hind tibiae in *I. nigrodentatus* are yellow.

XXIX.—*Description of a new Species of Draco from the Indo-Chinese Region.* By MALCOLM A. SMITH, M.R.C.S., L.R.C.P.

Draco indochinensis, sp. n.

Description of the Type.—Adult female, no. 1928. 6. 29. 1, British Museum of Natural History, collected at Bockor, Kamchay Mts., Cambodia, altitude 1000 metres, by Messrs. Delacour and Lowe.

Head moderate; snout obtusely pointed, a little longer than the diameter of the orbit; nostrils superior, directed almost straight upwards; tympanum naked. Upper head-shields unequal, strongly keeled; a small subconical tubercle at the posterior part of the supraciliary edge. Nine supralabials. Gular appendage two-thirds the length of the head, covered with largish scales. Dorsal scales unequal, smooth, ventral scales strongly keeled; a dorso-lateral series of distant, enlarged, strongly keeled scales. The fore limb extends to beyond the tip of the snout, the hind limb nearly to the axilla.

Greyish or bronze above, with small black spots; wings reddish brown above, with four very distinct black curved bands which bifurcate as they approach the body, below lemon-yellow with a large black spot anteriorly and a black stripe near the outer margin. Throat blue, with a broad, black, transverse bar extending on to the inner sides of the wattles.

From snout to vent 102 mm.; tail 180.

A second female specimen in the Museum collection (no. 1927. 5. 20. 19), obtained at Kontum, Annam (lat. 14° 50' N.), does not differ in any important respect from the type.

D. indochinensis appears most nearly related to *D. taniopterus*, Günther, from Siam and southern Burma. It differs in the shorter hind limb, in the colour-pattern of the throat, and in the larger size.

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[TENTH SERIES.]

No. 9. SEPTEMBER 1928.

XXX.—*The Godman-Thomas Expedition to Peru.*—VII.
The Mammals of the Rio Ucayali. By OLDFIELD THOMAS.

AFTER making the fine collection on the Rio Huallaga, of which an account was given in last December's 'Annals,' Mr. Hendee crossed the watershed into the drainage-area of the Upper Ucayali, on which river he made a series of collections at different localities between 7° and 11° S., thus covering the greater part of the main river. So full is this collection that I have taken the opportunity of inserting in the list—from published accounts or other previous Museum accessions—some further species known to occur on the main river from the Tambo-Urubamba junction down to Sarayacu—that is, the middle part of the river for a direct north-and-south distance of about 280 miles. On the upper river different parts or tributaries take on the names of Pachitea, Urubamba, Tambo, Perene, Apurimac, and Vilcanota, but the present paper is restricted to the main trunk known as the Ucayali and Alto Ucayali. Below—that is, northwards of—Sarayacu no collecting work seems to have been done.

We thus obtain a list of the known Ucayali mammals, amounting to seventy-four in all, although, of course, there must be in addition a considerable number which are not here recorded—both wide-spread S. American animals occurring

in the area and many bats and other small species which do not happen to have been obtained in the collections referred to.

The species quoted from other sources are:—

(1) Those recorded by Gervais under the heading of "Animaux nouveaux ou rares" collected by Castelnau and Deville on the Ucayali, mostly at Sarayacu (Castelnau, Voy. Am. du Sud, Mamm. 1855).

(2) Those collected by E. Bartlett on an expedition arranged by Dr. P. L. Sclater, the mammals being those registered in the Museum as nos. 66. 3. 28. 1-14 and 69. 3. 31. 1-20. Bartlett's paper on monkeys (P. Z. S. 1871, p. 217) was based on the observations then made, and there is a map of his localities (P. Z. S. 1873, p. 252).

(3) Those collected by Latham Rutter at Tushemo, near Masisea, in the middle of the stretch of river now dealt with. B.M. nos. 24. 2. 22. 1-72 and 24. 3. 1. 1-85. Several new forms there obtained were described by me (Ann. & Mag. Nat. Hist. (9) xiii. pp. 530 *et seqq.*, 1924).

The present collection is really a very fine one, numbering just on 300 specimens belonging to 52 species. Owing to previous work in the region there are not many novelties, but a new subspecies of *Cacajao rubicundus*, one of the remarkable short-tailed Uacari monkeys, is worthy of special mention. And the admirably collected series of all make work with them a pleasure.

Mr. Hendee gives me the following notice of the localities at which he worked*:—

"*Chicosa* (Upper Ucayali).—Chicosa is the name of a small settlement and of a stream on the west bank of the Upper Ucayali about 35 miles below the junction of the Urubamba and Tambo rivers. Altitude approximately 1000 ft. The whole region is covered with tropical forest.

"*Cumeria* (Loreto).—The locality listed as Cumeria refers to a post or hacienda at the mouth of the quebrada of Shahua. As this appears on no maps and cannot be considered a permanent name, I have given only the name 'Cumeria,' although the locality and quebrada of that name are on the opposite side of the Ucayali, at about 10° S. The region is typical of tropical forest country.

"*Contamana* (Loreto).—Contamana is a large village on the Ucayali at about 500 ft. altitude. Specimens marked

* A few specimens were also obtained at Inanez, Junin, on the high ground between Chanchamayo and the Upper Pachitea, at 5000'. Among these there is a second specimen, agreeing in all respects with the type, of the hitherto unique *Metachirus opossum nigratus*, Thos., described from Utcuyaco, Junin, 5200'.

'Contamana' come mostly from abandoned farms near the town. Those marked 'Cerro Azul,' 2000 ft., come from the hills about 20 miles from the river. The altitude in the Cerro Azul has surprisingly little effect on the temperature, which, while slightly cooler, is still very warm. Heavy forest. Both localities east of the Ucayali.

"*San Jeronimo* is a small village about 60 miles from Contamana and upstream, i. e. south, of that place. It is on the opposite or western bank of the Ucayali. Nearly all the specimens come from gardens about the village."

1. *Ateles ater*, F. Cuv.

♂. 1351; ♀. 1352, 1353, 1354, 1361. Chicosa, 1500'.

♂. 1393, 1399; ♀. 1404. Cerro Azul, Contamana, 2000'.

"Commonly kept as pets by Indians on the Ucayali and Huallaga."—*Bartlett*.

[*Ateles variegatus*, Wagn. (*A. bartletti*, Gray).

"Near Chamicuros and elsewhere."—*Bartlett*.]

2. *Alouatta seniculus*, L.

♂. 1409; ♀. 1418. Cerro Azul, Contamana, 2000'.

"Common and largely eaten by natives of Ucayali and Huallaga."—*Bartlett*.

3. *Cebus* species A.

♂. 1249, 1271, 1272, 1273, 1283, 1284, 1285; ♀. 1274, 1309. Cumeria, 1000'.

♂. 1365. Chicosa, 1500'.

♂. 1379, 1386. Cerro Azul, Contamana, 2000'.

The *Cebus* from Yurac Yacu I provisionally called *Cebus azarae pallidus* equally agrees with this Ucayali series.

A dark species with black legs and black tail. The majority without frontal tufts, but some with a slight tuft. The type of "*Cebus fatuellus peruanus*" agrees closely with this series, except that it has well-developed tufts. Perhaps the tufts will prove to be an entirely illusory character, as seems to be the case with almost every feature of these difficult animals.

4. *Cebus* species B.

♂. 1261, 1277; ♀. 1266, 1276. Cumeria, 1500.

♀. 1364. Chicosa.

♂. 1396. Cerro Azul, Contamana, 2000'.

A paler species with red legs and a whitish tail. The animal I described as "*Cebus flavescens cuscinus*" is clearly the same, as is also a *Cebus* obtained by Mr. Rutter at Masisea. The Chicosa specimen differs from the rest by having a somewhat tufted head, with less white on the face than the rest, but I do not venture definitely to distinguish it.

The fine series of these two species of capuchin will be of much value when an attempt is made to work out the genus on proper material, but at present I can do no more than indicate what forms inhabit our area. In any case, the types of "*peruanus*" and "*cuscinus*" so agree respectively with the two forms obtained by Mr. Hendee that there is no question as to the description of the latter.

5. *Lagothrix infumata*, Spix.

♂. 1359; ♀. 1350, 1360. Chicosa, 1500'.

♂. 1375, 1376, 1378, 1384; ♀. 1392. Cerro Azul, Contamana, 2000'.

Lower Ucayali (*Bartlett*).

6. *Lagothrix thomasi*, Ell.

♂. 1255, 1262, 1263; ♀. 1256, 1257, 1258, 1259, 1260, 1264, 1265. Cumeria, 1500'.

Some of a lighter, some of a darker grey, but on the whole agreeing nearly with Elliot's type, which came from Callanga, Cuzco.

7. *Cacajao rubicundus ucayalii*, subsp. n.

♂. 1385, 1390, 1391. Cerro Azul, Contamana, 2000'.

"Shot in forest. Skin of face dull red."—*R. W. H.*

General coloration as in true *rubicundus*, but the nape, instead of being whitish or pale yellowish, is bright chestnut-red like the rest of the body, and the line of demarcation between the red nape-hairs and the grey of the crown more sharply marked.

Skull essentially similar to that of *rubicundus*, but the molars rather smaller,

Dimensions of the type:—

Head and body 465 mm.; tail 180; hind foot 151; ear 33.

Skull: greatest length 97; basal length 71; upper pre-molar-molar series 22.

Hab. as above.

Type. Adult male. B.M. no. 28. 5. 2. 41. Original number 1391. Collected 29th October, 1927.

The discovery of a member of the remarkable genus *Cacajao* on the Ucayali is of much interest, as the genus had been supposed to have a very restricted distribution in the Tefé-Tonantins region of the Middle Amazon, while the Ucayali is a very long way further up the river. The character of the country is, however, of a sufficiently uniform nature to make it not improbable that examples of the red Uacari will be found in the intervening districts, and I therefore do not distinguish this animal as a separate species. The Museum has recently received from Herr Ehrhardt two excellent specimens of *C. rubicundus* from the Auty-Parana, close to Fonte-Boi, precisely agreeing with the various figures and descriptions of that animal, while the present three skins are uniformly distinguished by the characters above indicated.

Mr. Hendee is to be congratulated on this striking discovery, which, owing to the rarity of these monkeys, almost ranks in interest with that of the *Oreonax hendeei* of N. Peru.

8. *Pithecia monachus*, Humb.

♀. 1275. Cumeria, 1500'.

♂. 1355. Chicosa, 1500'.

Ucayali (*Castelnau*).

"Rare on Peruvian Amazon."—*Bartlett*.

9. *Callicebus cupreus*, Spix.

♀. 1417. Cerro Azul, Contamana, 2000'.

This species was also obtained by Bartlett at Cashiboya, E. of Sarayacu, and at Santa Cruz, Huallaga. A series collected by Ehrhardt in the typical region of the Solimões shows that the colour of the crown is so variable—rufous or grey—that *C. egeria* should probably be united with *C. cupreus*. The cranial differences described in *C. egeria* do not prove to be so constant as was supposed.

C. pænulatus, Ell., is also probably the same as *C. cupreus*.

Ucayali (*Castelnau*).

10. *Callicebus subrufus*, Ell.

♂. 1246; ♀. 1245, 1310, 1312. Cumeria, 1000'.

The Cumeria specimens closely match Elliot's type of *subrufus*, but the species is very nearly allied to *cupreus*, only differing by the presence of a white frontal band. The general body tone is more rufous than in *leucometopa*, and the ears are more prominently white.

11. *Saimiri boliviensis nigriceps*, Thos.

♂. 1267, 1269, 1314, 1315; ♀. 1268, 1270, 1313, 1316, 1317. Cumeria, 1000'.

♂. 1348; ♀. 1349. Chicosa, 1500'.

♂. 1424. Contamana, 500'.

A most interesting and instructive series, from which one can see how irregular the development of the black cap is, while at the same time it does get strongest in old age. The specimens from Tingo Maria on the Upper Huallaga, referred last December to *S. sciurea*, should also be called *S. b. nigriceps*, of whose local distinction I was then in doubt. But it would seem that the squirrel-monkeys of the Ucayali and Huallaga, and leading on into Bolivia, form genuine local races for which, as a whole, the specific name *boliviensis* may be provisionally retained. In all of these the ground-colour is more yellowish than in *sciurea*, and the white area behind the ears more extended and more sharply defined, so that the dark colour of the back of the neck, whether black or yellowish, is pinched in on the nape to be only somewhere about an inch broad, or even less. In *sciurea* the dark nape-line is less sharply defined and almost as broad as between the ears, and the general colour of the animal is far greyer. Then as to the subspecies, we find that of a good series from Bolivia almost all are really black-capped, and they all have 6-8 inches of the end of the tail black, and even on the proximal part of the tail there is a tendency to having the hairs black-tipped. In the Peruvian *nigriceps*, on the other hand, the majority have merely black tips to the ends of the crown-hairs, while many are wholly grey-headed. The black tail-tip is only 3-4 inches in length, while the base is without any black washing.

It should be noted that even in true *sciurea* of British Guiana and the Lower Amazon the dark mark between the eye and ear is often quite black, while in some cases rich black coronal lines are developed. But I have seen no specimens with wholly black caps.

Sarayacu (Castelnau), under name of *Saimiris entomophagus*.

12. *Aotus vociferans*, Spix.

♂. 1362, 1363; ♀. 1367. Chicosa, 1500'.

♀. 1434, 1435. Contamana, 500'.

The Contamana specimens agree closely with specimens from the Middle Amazon referred to *vociferans*; the Chicosa skins are more greyish. But determinations in this genus are very unsatisfactory owing to the intangible character of the different forms.

No doubt the *Nyctipithecus oseryi* of Bartlett.

13. *Callimico goeldii*, Thos.

♀. 1407, 1408. Cerro Azul, Contamana.

This is an important accession, as these two specimens are the first wild-killed examples of the remarkable intermediate *Callimico* that the Museum has received, its two previous specimens, the types of *Midas goeldii* and *Callimico snethlageri*, having both lived in the Para Zoological Gardens. Until 1920 no proper habitat was known, but in that year Mr. Pocock* mentioned a *Callimico* as from the "Ma" (probably Ina) River, Bolivia—a locality on the Upper Madeira, and not so very distant from the Ucayali.

It may be noted that in all our four specimens of *Callimico* the hairs of the throat and interramia tend to form a narrow median crest pointing forwards, the hairs in this region of the marmosets being all smoothly directed backwards.

I am inclined to agree with Mr. Pocock's opinion that *Callimico* should rather be considered as a primitive marmoset than as a member of the Cebidæ.

14. *Mystax mystax*, Spix.

Seven specimens. Cerro Azul, Contamana.

A very uniform series, except that the white bases to the hairs of the shoulders and sides are rather variable in their prominence, sometimes scarcely lighter than their tips and sometimes strongly contrasted. These light bases are, however, a very characteristic feature of the species, not occurring in any of its allies. In the somewhat similar *M. ursulus* there is no trace of them.

There seems to be no local difference between these Ucayali specimens and those of the Solimões, much further down the Amazon system.

* P. Z. S. 1920, p. 92.

15. *Mystax devillei pacator*, Thos.

Seven. Cumeria, 1000'.

These Cumeria specimens are all of the typically black-mantled *pacator* type, which inhabits the region of the Pachitea, Perene, and Upper Ucayali. The black of the crown is continued down the nape practically to meet the marbled region of the back without the intervention of an olive- or rufous-ticked mantle.

But in specimens from Tingo Maria on the Huallaga, and even more perceptibly on those from Yurac Yaku, there is a decided olive ticking of the mantle between the black of the crown and the marbling of the back. These specimens were in No. V. of the present series of papers referred to *M. devillei* owing to two Rutter marmosets from the neighbouring locality of Moyobamba being so like typical *devillei* of the Lower Ucayali. But a renewed examination of the whole series convinces me that while the Moyobamba specimens are rightly referable to *devillei*, with its strongly ticked, more or less rufous mantle and arms, those from Yurac Yaku, near as that locality is to Moyobamba, should be considered as different. But since there are various linking and intermediate specimens, probably the arrangement truest to nature would be to unite all the group as one species, with three subspecies—(a) *devillei* of Eastern Ecuador, the Lower Huallaga and Ucayali, and Moyobamba, (b) *pacator* of the Upper Ucayali, and (c) the marmoset of Yurac Yaku and Tingo Maria. This may be called

16. *Mystax devillei micans*, subsp. n.

♀. 1410. Cerro Azul, near Contamana.

General characters as in *M. d. pacator*, but the mantle finely olive-ticked between the black of the crown and the dorsal marbling, the ticking extending outwards on to the shoulders and arms, where it may be inclined to rufous, though much less so than in *devillei*. No dark patch on the knee, this being present in *pacator*, absent in *devillei*.

Measurements of type:—

Head and body 211 mm.; tail 299; hind foot 62.5; ear 26.

Hab. of type. Yurac Yaku, San Martin, N. Peru. Alt. 2500'. Other specimens from Tingo Maria and Chinchavita, Huanuco, Huallaga. A more doubtful specimen in the present collection from Cerro Azul, near Contamana.

Type. Adult female. B.M. no. 27. 1. 1. 28. Original

number 838. Collected 25th July, 1926, by R. W. Hendee. Godman-Thomas Expedition to Peru. Twelve specimens in all.

Sarayacu (typical *devillei*) (*Castelnau*).

17. *Mystax purillus*, Thos.

♂. 1356, 1357; ♀. 1358. Chicosa, Upper Ucayali.

A rare species, the only previous specimens known being the type, from the Acre, Upper Purus River, and the four examples obtained by Mr. Heller on the Cosireni and San Miguel Rivers in the Cuzco region of Peru.

The present specimens show well the characteristic white eyebrows mentioned in my account of Mr. Heller's collection *.

[*Cebuella pygmaea*, Spix.

Santa Cruz, Huallaga (*Bartlett*).

Specimen in British Museum; quite like examples from the typical region further down the Amazon.]

18. *Myotis nigricans*, Wied.

♂. 1279. Cumeria.

♀. 1455, 1456, 1468. San Jeronimo.

Sarayacu (*Castelnau*). ("*Vespertilio chilensis*.")

19. *Myotis chilensis oxyotus*, Pet.

♂. 1301. Cumeria.

♂. 1454; ♀. 1451, 1452, 1453, 1457, 1458, 1459. San Jeronimo.

Determined by Dr. Glover Allen.

20. *Thyroptera discifera*, Licht. & Pet.

♂. 1297, 1298, 1299, 1300; ♀. 1290, 1291, 1292, 1293, 1294, 1295, 1296. Cumeria.

"Caught roosting in banana-leaf."

Quite like specimens from Cayenne.

21. *Rhynchonycteris naso*, Wied.

♂. 1368. Contamana, 500'.

♂. 1480; ♀. 1478, 1479. San Jeronimo, 500'.

* Proc. U.S. Nat. Mus. lviii. p. 221 (1920).

22. *Saccopteryx bilineata*, Temm.

♀. 1280, 1281, 1282. Cumeria, 1000'.

♂. 1332, 1334, 1338, 1339, 1340. Chicosa, 1500'.

♀. 1436, 1437, 1438, 1439, 1440, 1441. Contamana, 500'.

Masisea (*Rutter*).[*Peronymus cyclops*, Thos. Masisea (*Rutter*).]23. *Noctilio leporinus*, L.

♂. 1287; ♀. 1304, 1305. Cumeria, 1000'.

[*Dirias* sp. Masisea (*Rutter*).]24. *Molossus obscurus*, Geoff.

♀. 1469. San Jeronimo, 500'.

Masisea (*Rutter*).[*Trachops cirrhosus*, Spix. Masisea (*Rutter*).]25. *Macrophyllum macrophyllum*, Wied.

♂. 1502. San Jeronimo, 500'.

"On tree-trunk over water."

A very rare bat—the first example of the genus we have received from Peru. Its characters are essentially similar to those of Eastern specimens.

26. *Carollia perspicillata*, Linn.

♂. 1238, 1239, 1240, 1241. Cumeria, 1000'.

♂. 1333. Chicosa, 1500'.

Masisea (*Rutter*).27. *Glossophaga soricina*, Pall.

♂. 1335; ♀. 1336. Chicosa, 1500'.

"In hollow log on ground."

Sarayacu (*Castelnau*).28. *Artibeus jamaicensis*, Leach.

♀. 1369, 1370, 1371, 1372, 1373. Contamana, 500'.

29. *Artibeus cinereus*, Gerv.

♂. 1414, 1415, 1416. Cerro Azul, near Contamana, 2000'.

[*Artibeus pumilio*, Thos.

Uroderma bilobatum, Pet.

Vampyrops zarhinus, H. All.

Vampyrodes ornatus, Thos.

Vampyriseus bidens, Dobs.

Chiroderma villosum, Pet.

Diphylla ecaudata, Spix.

All Masisea (*Rutter*).]

30. *Panthera onca*, L.

♂. 1403. Cerro Azul, Contamana, 2000'.

31. *Puma concolor*, L.

♀. 1405. Cerro Azul, Contamana, 2000'.

A very red specimen.

[*Tayra barbara*, L.

Lower Ucayali (*Bartlett*); Masisea (*Rutter*). Cf. *T. b. brunnea*, Thos. 1901.]

32. *Sciurus (Hadrosociurus) tricolor*, Poepp.

Eleven from Cumeria, Chicosa, and Contamana.

The bellies of these specimens vary from wholly buffy, through buffy and white, to wholly white, and there is considerable variation in the degree of rufous on the back.

[*Sciurus ignitus irroratus*, Gray.

Lower Ucayali (*Bartlett*).]

33. *Nectomys garleppi*, Thos.

♂. 1327, 1328, 1341, 1342. Chicosa, 1500'.

♂. 1495, 1506; ♀. 1448, 1463, 1494, 1507, 1508. San Jeronimo, 500'.

The general colour of these specimens, especially of those

from Chicosa, tends to be more buffy than the usual greyish of Brazilian water-rats. They agree very well with the type, which came from Ocobamba, on the Apurimac, higher up the same river.

In the genus *Nectomys* there seems to be a greater tendency for the development of local races than is the case in *Holochilus*.

34. *Holochilus sciureus*, Wagn.

♀. 1237. Cumeria, 1000'.

♂. 1464, 1486, 1493, 1522; ♀. 1447, 1461, 1462, 1496. San Jeronimo. 1000'.

"Trapped in brush near river."

As time goes on and material increases I am more and more convinced of the essential identity of all the *Holochilus* water-rats of the whole of the Amazonian drainage area, from Pernambuco to Peru, Guiana to Bolivia, and equally that of the Rio San Francisco. The form described as *incarum* is less buffy in colour, and may perhaps survive as a local highland subspecies. But even of this, while Rutter's Moyobamba skins are little buffy, those got by Hendee at Yurac Yaku, quite near by, are fully as buffy as any of the Lower Amazonian forms.

All over the world the conditions of life are so similar on a river from source to mouth that water-living animals are liable to remain uniform at distances immensely greater than is the case with ordinary land-mammals.

In the lengths of the feet of water-rats it is noticeable that instead of being relatively large in youth and small in old age, as with land animals, the feet are proportionally small to middle age and then gradually lengthen to old age, so that unnaturally different hind-foot lengths are found to occur in specimens that may all be called "adult." This characteristic is equally found in the water-rats of all parts of the world, in which therefore "hind-foot length" is a character that must be used with the greatest caution.

Externally *Holochilus* is so remarkably similar to *Nectomys* that skins can be sorted only with considerable difficulty, but the skulls and teeth are absolutely different, and perhaps indicate, as Winge suggested, an affinity with *Sigmodon*. *Nectomys*, on the other hand, shows relationship with *Rhipidomys* and other land Muridæ, its external resemblance to *Holochilus* being obviously the result of a similarly aquatic method of life.

Masisea (Rutter).

35. *Oryzomys laticeps nitidus*, Thos.

♂. 1381, 1397; ♀. 1400. Cerro Azul, Contamana, 2000'.

♂. 1467, 1508. San Jeronimo, 500'.
Masisea (*Rutter*).

36. *Oryzomys longicaudatus destructor*, Tsch.

♂. 1491. San Jeronimo, 500'.

Apparently less common on the Ucayali than in N. Peru, where Mr. Hendee and other collectors obtained it in large numbers. It is the animal successively known as *O. minutus*, Tomes, and *O. stolzmanni*, Thos.

Masisea (*Rutter*).

37. *Neacomys spinosus*, Thos.

♂. 1308. Cumeria, 1000'.

♂. 1470; ♀. 1507. San Jeronimo, 500'.

Masisea (*Rutter*).

38. *Rhipidomys leucodactylus*, Tsch.

♂. 1446, 1465, 1511, 1512; ♀. 1445, 1466. San Jeronimo.

Mostly rather immature.

39. *Ecomys superans*, Thos.

♂. 1509; ♀. 1490, 1497, 1519, 1524. San Jeronimo, 1000'.

This series is very uniform in colour and general external appearance, but the skulls, all adult, range in length from 32 to 37.5 mm., and the teeth from 4.8 to 5.2. This range inclines me to think that *Æ. palmeri* is not really distinct from *Æ. superans*.

There would seem to be nothing to distinguish the Ucayali bush-rat from the Ecuadorean *Æ. superans*, also found on the eastern slopes of the Andes chain. The Yungas *Æ. mamoræ* has the belly-hairs white to their bases. Throughout the tropical regions of S. America almost every district has two members of this genus—a larger one, the size of a rat, and a much smaller one, that of a large mouse. The species are by no means sharply defined, and there is considerable intergradation in size, which is, however, the chief character

one has to go by. The present determinations must therefore be looked upon as somewhat provisional. The smaller Ucayali *Æcomys* is also related to one described from Ecuador.

40. *Æcomys bicolor*, Tomes.

♂. 1498, 1520, 1521, 1529. San Jeronimo, 500'.

[*Dactylomys dactylinus*, Desm.

Sarayacu (*Castelnau*).

Isothrix villosa, Gerv.

Sarayacu (*Castelnau*).

Isothrix villosa mollis, 'Thos.

Masisea (*Rutter*).]

41. *Proechimys brevicauda*, Günth.

Twenty-nine specimens, representing all the riverain localities concerned.

The bewildering instability of the characters of these spiny rats makes it at present impossible to sort them according to locality into separate species, subspecies, or local races. Whether representing the forms which have been called *brevicauda*, *simonsi*, *pachita*, or *hilda*, they all seem too variable to distinguish at all constantly from each other. Externally their general colour may be deep or pale, their bellies white or partly or wholly buffy, their thighs white or buffy, their feet blackish, particoloured, or whitish. In the skulls the size varies from a length of 67 mm. to one of 53; the palatal foramina may be short, intermediate, or long, and altogether I confess myself defeated in any attempt at present to distinguish the local races.

No further specimens were obtained of the blackish *P. rattinus* discovered by Mr. Rutter at Masisea, also on the Ucayali.

[*Proechimys rattinus*, Thos.

Masisea (*Rutter*).]

42. *Mesomys ferrugineus spicatus*, Thos.

♂. 1442, 1443. Contamana, 500'.

"In abandoned house."—R. W. H.

By their well-pencilled tails these specimens confirm the

distinction of the Upper Amazon *Mesomys* from that of the East, mentioned when this subspecies was described. One is strongly speckled above, the other less so. By their pale-coloured bellies both agree with the type, which came from Masisea, a little further up the river. Rutter collection.

43. *Dasyprocta variegata*, Tsch.

♀. 1419. Contamana, 500'.

44. *Mazama americana*, Erxl.

♀. 1402. Cerro Azul, Contamana, 2000'.

45. *Bradypus infuscatus*, Spix.

♀. 1232. Upper Ucayali, above Cumeria, 1000'.

"Caught swimming in the river."—R. W. H.

No doubt the result of some tree having fallen into the river with the sloth on it. Probably a sloth's peculiar hair would enable it to float quite easily, but its swimming abilities may be doubted.

The skull is decidedly larger than any of the fine series of Lower Amazon skulls—from Para and Marajó—that we now possess, so that the latter would appear to be different from the Upper Amazon *infuscatus*, and should apparently bear the name of *B. marmoratus*, Gray.

This skin, although marked ♀, has got a speculum on the back, and I should have therefore supposed it to be a male. But I now feel less sure than I did that the speculum is invariably indicative of the male sex and is never found in the female, and I therefore leave the record as Mr. Hendee made it.

From the few specimens of the Upper Amazon sloth that we have, however, it would seem that there is here an exception to the otherwise general rule that sloths either have specula (males) or mammæ (females), and never both, for both occur in Bartlett, Rutter, and Hendee specimens. Whether in *infuscatus* a speculum is developed in the female or mammæ are perceptible in the male must await better material of authentically sexed specimens*.

In connection with this animal I am able to make the interesting statement that the actual type of Linnæus's *Bradypus tridactylus* is the Seba-Lidth de Jude specimen in

* As may be gathered from Mr. Pocock's remarks (P. Z. S. 1924, p. 1027) the sexing of sloths is a difficult matter, so that collectors' records must be taken *eum grano salis*.

the Museum Collection—no. 67. 4. 12. 579. It is an adult female preserved in spirit.

It had already been mentioned in my paper on the Seba collection *, but under the then usual name of *B. cuculliger* for the Guianan species, so that my attention was not drawn at that time to the possibility of its being the type of *tridactylus*, while, when preparing the paper on the species of *Bradypus* † twenty-five years later, the same possibility was forgotten. It is therefore interesting to find that this specimen shows clearly the well-marked characters of the true *B. tridactylus* of Guiana, while on other grounds, in the paper on Linnæus of 1911 ‡ the type-locality of *tridactylus* was fixed as Surinam, the conclusions in the three papers thus confirming each other.

With the increased number of identifications, there can be no doubt that this specimen is the original of the very fair figure given by Seba (pl. xxxiii. fig. 2), on which, as independently stated in the Linnæan paper, the name *Bradypus tridactylus* was primarily founded.

46. *Myrmecophaga tridactyla*, L.

♀. 1413. Cerro Azul, Contamana, 2000'.

Young skin; no exact locality.

47. *Tamandua tetradactyla*, L.

♀. 1366. Chicosa, 1500'.

Quite normally coloured, with no approach towards the black *T. t. quichua* obtained by Mr. Hendee at Yurac Yaku, Northern Peru.

[*Cyclopes didactylus*, L.

Masisea (Rutter).

Didelphis marsupialis, L.

Sarayacu (Castelnau).]

48. *Metachirus opossum canus*, Osg.

♀. 1244. Cumeria, 1000'.

♂. 1331; ♀. 1320, 1321, 1322, 1329. Chicosa, 1000'.

♂. 1528. San Jeronimo, 500'.

* P. Z. S. 1892, p. 314.

† Ann. & Mag. Nat. Hist. (8) xix. p. 352 (1917).

‡ P. Z. S. 1911, p. 132.

49. *Metachirus nudicaudatus infuscus*, Thos.

♂. 1432. Contamana, 500'.

50. *Philander laniger ornatus*, T'sch.

♂. 1347. Chicosa, 1500'.

Masisea (*Rutter*).51. *Marmosa rutteri*, Thos.

Twenty specimens from San Jeronimo and Contamana.

A very uniform series, agreeing closely with the type, which came from Tushemo, near Masisea, further up the Ucayali. The mammæ number $4-1-4=9$, as in *M. germana* and other members of this group.

Compared with the specimens referred to *M. germana* from Chinchavita, Huanuco, also obtained by Mr. Hendee, these Marmosas are uniformly distinguished by their shorter fur, paler and more greyish general colour, and less strongly ochraceous under surface. All have tails brown to the tip. The muzzle between the eye-patches is prominently more yellowish than the rest of the upper surface.

52. *Marmosa quichua*, Thos.

♂. 1346; ♀. 1343. Chicosa.

♀. 1377, 1387. Cerro Azul, Contamana.

♂. 1431; ♀. 1423. Contamana.

The end of the tail always lighter, but sometimes very slightly so, thus connecting *musicola* with *quichua*. Type from Ocobamba, in the Cuzco region.

Mammæ not yet known.

53. *Marmosa madescens*, Osg.

♀. 1429. Contamana, 500'.

♂. 1481, 1487, 1503, 1513; ♀. 1460 (in al.), 1471, 1472, 1482, 1501, 1523 (in al.), 1527. San Jeronimo, 500'.

The external resemblance of this species to *quichua* is very noticeable, as they can often only be certainly distinguished by the non-possession of supraorbital beads. Their general colour averages a little darker, but there are individual exceptions to this rule. The nearly allied *M. sobrina* of Ecuador is larger and still darker in colour. Type from near Molinopampa, N. Peru.

Mammæ $3-1-3=7$.

XXXI.—*Revisionary Notes on the Diopsidæ (Diptera)**. By
E. BRUNETTI. (Edited by C. H. CURRAN; re-edited by
E. E. AUSTEN.)

THE opportunity of examining a very large number of Diopsidæ contained in various collections first induced me to attempt a revision of the family, and the privilege of inspecting the types of Westwood in the Hope collection at the Oxford University Museum, through the favour of Prof. E. B. Poulton, afforded a further basis for their study. Those of Westwood's types in the Hope collection which were not actually labelled as such were carefully identified many years ago by Colonel Yerbury, and as most of them were apparently uniques the possibility of error is infinitesimal. A large amount of unnamed material in the British Museum, in addition to the named species in the general collection,

* This is the title of the original treatise on the family under preparation at the time of the death of the author; it has been left unchanged. Shortly before he died, Mr. Brunetti was engaged, among other things, in the preparation of a revision of the family Diopsidæ or Stalk-eyed Flies, and it is most unfortunate that he was unable to finish this work. With one solitary exception, these interesting flies, which have attracted much attention on account of their peculiarly developed heads, are found only in the Old World. The literature dealing with them is scattered and, since 1837, no previous attempt has been made to compile a list of all the described species, although, in 1925, Eggers published a catalogue of the African forms. Eggers, however, overlooked Hendel's "Afrikanische Diopsiden" (Wiener Ent. Zeit. Bd. xl. pp. 33-42, 1923), while Brunetti was not aware of the paper by Eggers, "Diopsiden aus Deutsch-Ostafrika" (Zool. Jahrb., Abt. f. Syst., Geogr. u. Biol. der Tiere, Bd. xlix. pp. 469-500, Taf. 6, 1925). Inasmuch as there are no changes to be made in the portion dealing with the genus *Teleopsis*, Rond., as a result of this oversight by Brunetti, it is considered advisable to publish this part of the manuscript at the present time. In order that the intention and methods of the author may be understood, the original introduction to the entire paper is included herein. Brunetti's descriptions of new species will be found below, after the present writer's "Review of the African Species of *Sphyracephala*, Say."

Much valuable information concerning the species described by Westwood has been accumulated by Brunetti, who examined the types and noted differences not contained in the original descriptions, and these notes will be included in the present contribution and in the portion of the manuscript to be revised later.

Remarks of the Editor are contained in square brackets []: all other matter is to be ascribed to Brunetti.—C. H. C.

Mr. Brunetti's manuscript, after receiving revision by Mr. Curran, to whom it had been submitted by Dr. G. A. K. Marshall, C.M.G., F.R.S., was found still to require a considerable amount of correction. The necessary emendations, which need not be indicated more precisely, have been made by myself.—E. E. AUSTEN,

which contains many of Walker's types; a considerable amount from widely separated African localities, received for identification by the Imperial Bureau of Entomology; a number of obviously new species from various museums, and, lastly, a large number of specimens in the Belgian Congo Museum have in the aggregate afforded me an exceptional opportunity to undertake this revision. The collections also received for study from the Paris Museum, South African Museum, and Durban Museum have in every case yielded new species, and my thanks are most sincerely tendered to the Directorates of all the institutions through whom this paper has been rendered possible.

A certain number of names of species have been attributed to Westwood to which that author himself appended the names of other authors, such as *meigenii*, Wied. MS., *erythrocephala*, Klug MS., etc., and it is not clear whether the names adopted were merely manuscript ones or whether they were actually described (though not published) by the authors in question. [See description of *D. trentepohlii*, Westwood, Trans. Linn. Soc. London, vol. xvii. p. 546, 1837. The statement of Westwood indicates that this description was entirely his own, and the general equality of all the descriptions in the same paper would indicate that all were by him, and not by others.] I have followed contemporary writers in regarding them as Westwood's species.

In estimating the length of the eye-stalks I have measured (with the eye alone) from the side of the head to the tip of the eye itself, as being the method least liable to error, and in any case there is certainly some variation in their length within the species. This does not seem to be a sexual character, except perhaps in some species, and I have come to regard small differences in their length as unimportant.

The vertex and frons are practically inseparable in many species, but the transverse groove usually present, accentuated by a narrow blackish line uniting the bases of the eye-stalks may be regarded as delimiting these two parts of the head; all below this groove being the enormously developed face, frequently bearing a fine longitudinal impressed line.

Subgenera might reasonably be established on the presence or absence of the facial teeth, as in all the species seen by me they are quite definite when present, but in some recently described species (*Diopsis hoplophora*, Hend., and *D. finitima*, Egg.) they are reported as weak.

In the first of two recent papers of mine on Belgian Congo material, a large batch of data concerning known Diopsidæ was given, while descriptions of nine new species were

included in the second*. These data are not repeated in the following pages, all those now presented being, so far as I know, new, except in the case of types or special instances.

As regards one species, *Diopsis circularis*, Macq., I have considerable doubt whether the African form which has been referred thereto has been correctly determined. As the most likely solution of the difficulty I have regarded the African form as *D. macquartii*, Guér., which was described from a specimen from the Casamance R., Upper Senegal, and of which the remnants of the type still exist in Paris.

TELEOPSIS, Rondani.

African Species.

Teleopsis nitida, Adams.

Described from an unique male from Salisbury, Mashonaland; judging from the three transverse dark bands on the wing, the species should be thoroughly valid.

Teleopsis erythrocephala, Westwood.

Diopsis erythrocephala, Westwood, Trans. Linn. Soc. Lond. vol. xvii. p. 544, Tab. xxviii. fig. 2, 1837.

The type was originally in the Royal Museum, Berlin. There is a specimen from the Guérin-Ménéville collection in the Paris Museum, in very bad condition, labelled "Kl. M.S.S. Cap.," and is the only one seen by me that might possibly belong to this species.

Head brownish orange, facial teeth distinct, rather small, head in profile distinctly convex, eye-stalks about as long as from neck to hind margin of scutellum; antennæ concolorous, arista very long. Thorax black, as are neck and scutellum; spines brownish yellow, tips very narrowly black. Abdomen with the short basal part that remains, black. Middle femora brownish yellow, tibiae and tarsi dark brown. Wings missing except the pale grey extreme base. The only discrepancy between the above and Westwood's original description is that, in the latter, the eye-stalks are stated to be "shorter than the thorax."

* [Rev. Zool. Afr. t. xiii. pp. 170-173, 1925; *loc. cit.*, t. xiv. pp. 73-84, 1926.]

Teleopsis leucochira, Bezzi.

A comparatively recently described species, found in Belgian Congo.

[Evidently a true *Diopsis*; type not examined by Brunetti.]

Teleopsis arabica, Westwood.

Diopsis arabica, Westwood, *ibid.*, p. 544, Tab. xxviii. fig. 8.

Not strictly African, but included here, partly because it may occur in north-east Africa, and partly because it might otherwise be entirely overlooked, being the only species not occurring in either Africa or the Orient. Originally found in Arabia Deserta, and noted as very near *Diopsis collaris*, Westw.

Teleopsis wiedemanni, Westwood.

Diopsis wiedemanni, Westwood, *ibid.*, p. 543, Tab. xxviii. fig. 2.

Westwood compares this species to *D. ichneumonea*, L., to which the description applies generally, but in his figure he shows the front thoracic spines characteristic of *Teleopsis*, and the wing-spot is different. The species has never come before me.

Teleopsis sulcifrons, Bezzi.

Recently described from a beautiful unique example in the Belgian Congo Museum.

[This species belongs to the genus *Diopsis*, and there are many specimens from the Congo in the American Museum of Natural History.]

Oriental Species.

Teleopsis fallax, Bigot.

The type, in inferior condition, is in the Bigot collection (now in the possession of Mr. J. E. Collin, Newmarket).

Teleopsis fulviventris, Bigot.

Type in Bigot collection; the species has not been again recorded since it was described.

Teleopsis motatrix, Osten-Sacken.

Apparently not seen since the time of its description. Philippine Is.

Teleopsis discrepans, Walker.

Three co-types from Sarawak (*Wallace*) in the British Museum; also specimens in the same collection from Singapore, viii. 1924 (*H. N. Ridley*), and from Penang (*H. N. Ridley*). A specimen in the Indian Museum from Tenasserim was recorded by me years ago as probably *T. longiscopium*, Rond.

Teleopsis quadriguttata, Walker.

This is about the commonest of the Oriental species, so far as my experience goes. Type from Malacca in the British Museum, with other specimens from Pulo Penang; Borneo; Mt. Hoozan and Taihorin (both Formosa). The two latter were determined by Dr. Kertész as *T. bigotii*, Hendel. The type of *Diasemopsis fenestrata*, Big. (manuscript name only), is in the Indian Museum, and, as noted by me years ago, is also conspecific. *T. rubicunda*, v. d. Wulp, has been suggested as synonymous with *T. quadriguttata*, Walk., but I believe incorrectly.

Teleopsis rubicunda, v. d. Wulp.

After studying an unnamed series found by me in the Oxford Museum, I think it possible that this form is distinct from the foregoing owing to its more orange-red colour, larger size, more blackish hind femora, and somewhat different wing-markings. Two specimens from Ceylon are in the British Museum; at Oxford there is an example from Singapore Botanic Gardens, v.-vi. 1905 (*H. N. Ridley*).

Dr. J. C. de Meijere, in recording some specimens from Java, regards *T. rubicunda* as a valid species.

Teleopsis sykesii, Westwood *.

Diopsis sykesii, Westwood, *ibid.*, p. 310, Tab. ix. figs. 18, 19.

Type in Hope collection, Oxford, with a second specimen labelled "*sykesii*, G. R. Gray, East India, Major Sykes, No. 1"; also "W". Remains of five others labelled "W" also present, of which three bear very small pink labels marked "2," "3," and "4," corresponding to those on the type and the second specimen.

In the British Museum from Bombay and Mysore, 4400 ft., in Mus. Nat. d'Hist. Nat., Paris, from India.

* This species is the genotype of *Teleopsis*, Rond.—E. E. AUSTEN.

Teleopsis selecta, Osten-Sacken.

Apparently not seen since its description. Philippine Is.

Teleopsis bipunctipennis, R. Senior-White.

Teleopsis bipunctipennis, Senior-White, Mem. Dept. Agric. India, Entom. Ser. vol. vii. no. 9, p. 165, pl. xiii. fig. 1, December 1922.

Described recently from specimens from Ceylon; type, allotype and paratypes in British Museum.

CATALOGUE OF DIOPSIDÆ OF THE GENERA *TELEOPSIS* AND
SPHYRACEPHALA.

TELEOPSIS, Rondani.

Ann. Mus. Civ. Gen. vii. p. 448, 1875.

nitida, Adams, Kaus. Univ. Sci. Bull. ii. p. 46, 1904 (1905).
—S. Rhodesia.

[Type: Kansas University Museum.]

erythrocephala, Westw., Tr. Linn. Soc. xvii. p. 544,
Tab. xxviii. fig. 2, 1837.—Cape of Good Hope.
Type in Berlin Museum.

[*Diopsis*?] *leucochira*, Bezzi, Ann. Soc. Ent. Belg. lii. p. 387,
1908.—Belgian Congo.
Type in Natural History Museum, Brussels.

wiedemanni, Westw., Trans. Linn. Soc. xvii. p. 543,
Tab. xxviii. fig. 1, 1837.—Guinea.
Type in Wiedemann collection.

[*Diopsis*?] *sulcifrons*, Bezzi, Ann. Soc. Ent. Belg. lii. p. 387,
1908.—Belgian Congo.
Type in Belgian Congo Museum.

*arabica**, Westw., Trans. Linn. Soc. xvii. p. 544, Tab. xxviii.
fig. 3, 1837.—Arabia Deserta.
Type in Berlin Museum.

fulviventris, Big., Ann. Soc. Ent. Fr. (5) x. p. 94, 1880.—
India.
Type in J. E. Collin collection (Bigot coll.).

* Not recorded from Africa, but included here in the same sequence of species as in the table, and it may quite possibly occur in North-East Africa.

fallax, Big., Ann. Soc. Ent. Fr. (5) iv. p. 111, 1874 (*Diopsis*).
—Borneo.

Type in J. E. Collin collection (Bigot coll.).

trichophoras, de Meij., Tijd. v. Ent. lxxviii., Supplement, p. 89,
1916.—Sumatra.

Type in Amsterdam Museum.

motatrix, Ost.-Sack., Berl. Ent. Z. xxvi. p. 236, fig. 12, 1882.
—Philippine Is.

Type ?

discrepans, Walk., Journ. Proc. Linn. Soc. i. p. 134, 1857
(*Diopsis*).—Borneo, [Formosa], Malacca.

belzebuth, Big., Ann. Soc. Ent. Fr. (5) iv. p. 118, 1874 (*Diopsis*)*.

breviscopium, Rond., Ann. Mus. Civ. Gen. vii. p. 443, 1875.

longiscopium, Rond., loc. cit. p. 444, 1875.

belzebuth, Hend., Ent. Mitt. ii. p. 37, 1913.

bigoti, Hend., Supp. Ent. no. 3, p. 94, nom. nov. for *belzebuth*, Hend.,
nec Big., 1914.

Cotypes in British Museum.

sexguttata, sp. n. (see below).

Type in British Museum.

truncata, sp. n. (see below).

Type in British Museum.

quadriguttata, Walk., Journ. Proc. Linn. Soc. i. p. 37, pl. ii.
fig. 6, 1857 (*Diopsis*).—Malacca, Borneo, Formosa.

Diasemopsis fenestrata, Big., nom. MS.

Type of *Diopsis quadriguttata* in British Museum.

Type of *Diasemopsis fenestrata*, a manuscript name only, in
the Indian Museum.

rubicunda, v. d. Wulp, Tijd. v. Ent. xl. p. 196, pl. viii. fig. 6,
1897; de Meijere, *ibid.* li. p. 117 (descriptive notes).—

Java, Ceylon, Singapore.

Type ?

adjacens, sp. n. (see below).

Type in British Museum.

* This and the two following synonyms are taken from the British Museum collection, in which they were established by me in 1907, when they were recorded on labels placed beneath the label of *T. discrepans*. So far as I am aware, they have not hitherto been published.—
E. E. AUSTEN.

sykesii, Westw., Trans. Linn. Soc. xvii. p. 310, tab. ix. figs. 18, 19, 1837 (*Diopsis*); Rondani, Ann. Mus. Civ. Gen. vii. p. 442, 1875.—India, Borneo.

Type in Hope Museum, Oxford.

selecta, Ost.-Sack., Berl. Ent. Z. xxvi. p. 236, fig. 13, 1882.
—Philippine Is.

Type ?

bipunctipennis, Sen.-White, Mem. Dept. Agric. Ind., Entom. Ser. vii. p. 165, pl. xiii. fig. 1, 1922.—Ceylon.

Type in British Museum.

SPHYRACEPHALA, Say.

Amer. Entom. iii. pl. 52, 1828.

brevicornis, Say, Journ. Acad. Nat. Sci. i. p. 23, 1817 (*Diopsis*); Wiedemann, Auss. Zwei. Ins. ii. p. 563, 1830 (*Diopsis*); Westwood, Trans. Linn. Soc. xvii. p. 311, tab. ix. fig. 20, 1837 (*Diopsis*).—N. America.

hearseiana, Westw., Ann. & Mag. Nat. Hist. xvi. p. 274, 1845 (*Diopsis*).—India.

[NOTE.—The 'Proceedings of the Entomological Society of London' for 1840–46 were reprinted in 1864, when the pages were differently numbered.]

Westwood, 'Cabinet of Oriental Entomology,' xxxvii. pl. xviii. fig. 3, 1848 (*Sphyracephala*—sic).

beccarii, Rond., Ann. Mus. Civ. Gen. iv. p. 289, 1873 (*Diopsis*).—Abyssinia.

cothurnata, Big., Ann. Soc. Ent. Fr. (5) iv. p. 115, 1874 (*Diopsis*); Ost.-Sack., Berl. Ent. Z. xxvi. p. 234, 1882.
—India, Philippine Is.

africana, Karsch, Berl. Ent. Z. xxxi. p. 380, Taf. iv. fig. 11, 1887.—E. Africa.

nigrimana, Loew.—Siberia.

[No reference to this species is before me, except that by Osten-Sacken, *loc. supra cit.* p. 235. A review of the species was given by him.]

[*succini*, Loew, Prussian amber. Mentioned by Osten-Sacken, *loc. cit.*, but otherwise untraceable.]

sp. n.*.—S. Africa.

* Described below by Curran under the name *S. munnroi*.—E. E. AUSTEN.

XXXII.—*Review of the African Species of Sphyracephala, Say.* By C. H. CURRAN.

THE catalogue of this genus was found to be incomplete. I have been unable to locate the descriptions of two species described by Loew, although other omissions have been rectified.

It appears most probable that only the two African species of *Sphyracephala* are at present known, since it seems likely that the species described by Karsch is the same as Rondani's *Diopsis beccarii*. The new form described below is very different from all the others, as proven by the key given by Osten-Sacken.

Table of African Species.

- | | |
|--|----------------------------|
| 1. Tibiæ and tarsi largely or wholly yellowish | 2. |
| Tibiæ, tarsi, and scutellar spines brown | <i>munroi</i> , sp. n. |
| 2. Posterior tibiæ wholly yellow | <i>africana</i> , Karsch. |
| Posterior tibiæ with apical brownish band | <i>beccarii</i> , Rondani. |

Sphyracephala munroi, sp. n.

Blackish brown, thinly grey pollinose, mesonotum with brown pollen; tibiæ and tarsi wholly brown. Length 4.25 mm.

Female.—Face, except sides and lower border, and the anterior surface of eye-stalks, reddish yellow; antennæ reddish, third segment above and arista black; frontal and ocellar bristles long; hair of front brown, of face white. Palpi brown.

Spines on thorax brown; hair on pleura whitish, on mesonotum and scutellum blackish; scutellar spines brown, bristles black.

Coxæ and femora yellow, apical third of femora, and tibiæ and tarsi wholly, brown; anterior femora brown on apical half of anterior surface.

Wings cinereous hyaline, apex somewhat brown; veins brown.

Abdomen with sparse fine whitish hair, dorsum with obscure blackish hair towards apex.

Holotype, ♀, Transvaal (Barberton, Farm Stentor), 7. vi. 1925 (H. K. Munro): in coll. H. K. Munro.

Sphyracephala beccarii, Rondani.

Diopsis beccarii, Rondani, Ann. Mus. Civ. Stor. Nat. Genova, iv. p. 289, 1873.

Three ♂♂, six ♀♀, Barberton, Transvaal, S. Africa (H. K. Munro), 7. vi. 1925, 7. xi. 1919.

These specimens agree with Rondani's description, except that most of them lack the white tip to the apical abdominal segment. This does not show at all in any of the males. The "black band" on the posterior tibiæ is brownish, sometimes rather weak and obsolete dorsally and ventrally. This species is undoubtedly distinct from *S. hearseiana*, Westw., which is described as having a shining black abdomen.

Sphyracephala africana, Karsch.

Sphyracephala africana, Karsch, Berl. Ent. Z. xxxi. p. 380, Taf. iv. fig. 11, 1887.

From the description this species is very close to *S. (Diopsis) beccarii*, Rondani, and possibly identical. The only difference appears to be in the absence of the brown band on the apical sixth of the posterior tibiæ. No specimens with this band entirely absent are available.

XXXIII.—New Species of Diopsidæ (*Diptera*).

By E. BRUNETTI*.

Teleopsis sexguttata, sp. n.

♀.—Siam. Long. 6–7.5 mm.

Head, seen from in front, with nearly parallel sides; dark mahogany-brown, more orange-brown towards tips of eye-stalks; latter as long as from neck to tip of scutellum, rather stout; vertical bristle normal, a long spiny bristle at tip of eye-stalk. Antennæ orange-brown, arista very long. Vertex much flattened, a small depression just below the very distinct, raised ocellar tubercle; lower part of frons with two bright brown, almost red, transverse calli-like marks, separated from each other in median line but carried upwards to base of eye-stalks. Face in profile rather prominent in centre, seen from in front, rather swollen and divided longitudinally and horizontally by a deep impressed line each way, dividing it into four fairly distinct sections, below which is a similar piece covering the mouth-opening. Facial teeth strong; mouth-parts dark brown, labella large.

* The following descriptions, drawn up two or three years ago by the late Mr. Brunetti, were found after his death among his unpublished papers.—E. E. AUSTEN.

Thorax, including scutellum and spines, all blackish brown, shining; spines with rather short apical setæ*.

Abdomen shining black, distinctly clavate, being three times as wide at broadest part as at base; a small greyish spot on hinder part of second segment towards each side, and longer ones in similar positions on third segment. Genitalia brownish, with yellow parts.

Legs.—Fore femora considerably incrassate, minute teeth below on more than apical half, with also some long fine pale hairs; fore tibiæ black, fore tarsi blackish at base, remaining part pale brown, distinct golden-brown pubescence below first tarsal segments. Posterior legs dark brown, femora basally, and tarsi wholly much paler or even yellowish.

Wings blackish brown; base hyaline, except behind anal cell; an oblong hyaline spot from costa to hind margin of first basal cell, just clear of anterior cross-vein; a round spot in a line with it on hind margin of wing; a roundish spot on hind margin of first posterior cell near base; a large spot on costa, beyond middle of wing, with second vein running through it; a large spot in a line with it on hind margin of wing, at base of second posterior cell; and a fairly wide apical band, all hyaline, the apical band rather less hyaline at extreme tip. *Halteres* pale yellow.

Described from three ♀♀ from Siam, Bukit Besar, 2500 ft., 26. viii. 1901 (*H. C. Robinson and N. Annandale*). Type and two paratypes in British Museum. In the third specimen the head and body are rather dark reddish brown, and the fore femora are without the black apical ring but have a small black spot at the tip on the outer side. The abdomen is more slender, less abruptly clavate, and only twice as wide at its widest part as at its narrowest. The scutellar spines possess apical setæ (which, in the case of the type and in the other paratype, are presumably broken off). It is, however, just possible that the specimen may be specifically distinct. Apart from the scutellar spinal setæ and the above differences, which are by no means important, the specimen is typical.

Teleopsis adjacens, sp. n.

♀ (?).—Siam. Long. 5.5 mm.

Having the general appearance of the reddish-brown specimen of *T. sexguttata*, Brun. (*vide supra*), but differing

* Present in the palest of the three specimens before me, broken off in the type and remaining specimen. All three are obviously conspecific.

fundamentally in the absence of facial teeth ; the structure of the face is also different, being produced rather distinctly in the middle, and the median tubercle having a short, vertical, impressed line. Below the median tubercle the face protrudes to the edge of the mouth-opening. Lower corners of face with rounded angles, without any indication of teeth. A vertical row of about eight or nine long, fine, stiff hairs, and a row of finer hairs on the *front* side of the eye-stalks ; latter as long as from frons to tip of scutellum.

Thorax exactly as in *T. sexguttata* ; scutellar spines with long setæ.

Abdomen shaped practically as in *T. sexguttata*, though a little narrower in widest part. A whitish transverse spot on each side on about hind margin of first segment, and a similar, larger, lateral one over base of third segment (hind margins of segments rather indistinct).

Legs as in *T. sexguttata*, but rather less than apical halves of middle and hind femora distinctly blackish, and posterior femora apparently somewhat more pubescent.

Wings much as in *T. sexguttata*, but basal part nearly all hyaline as far as anterior cross-vein ; hyaline area extending further in subcostal cell, but a small brownish streak from tip of anal cell to hind margin of wing. Middle clear spot in median transverse row of three spots squarish, not round, nearly contiguous to anterior cross-vein, reaching from third to fourth vein, and almost in contact with upper spot of the set of three and with posterior cross-vein.

Described from a solitary specimen in the British Museum from Talum, Siam, 24. i. 1902 (*Robinson and Annandale*).

The resemblance between this quite valid species and the brown variety of *T. sexguttata* is very striking, but the absence of facial teeth and the different structure of the face afford ready means of distinction.

Teleopsis truncata, sp. n.

♂ (?).—Siam. Long. 6 mm.

Head shining orange-brown, with usual transverse black line across frons. Antennæ yellowish, arista long. Distance from middle of vertex to tip of eye about as long as one wing. Face rather prominent on upper part and again above mouth-border ; lower corners of face without teeth, but squarish ; head, viewed from in front, only slightly narrower above than below. Labella very large, greyish brown, conspicuously ribbed.

Thorax shining orange-brown ; scutellum a little more

yellowish, spines quite black, with conspicuous, long, fine, well-separated, stiff hairs; no apical setæ.

Abdomen shining orange-brown on first and second segments; third segment changing rapidly to shining black like remaining portion. A whitish diagonal streak, glistening brightly when viewed from certain directions, at base of third segment on each side, cutting off basal angle.

Legs shining orange-brown, fore femora of distinctive shape, being notched on underside near tip, remaining apical (upper) portion being only half normal depth, and black on its underside; usual teeth present for three-fourths of length of femur, whole limb with long fine pale stiff hairs on all sides except inner. Fore tibiae all black. Fore tarsi very distinctive, first tarsal segment being unusually long and rapidly dilated to tip, which is blackish; remaining segments small, brownish yellow. Posterior femora almost imperceptibly thickened a little before tips, where they are darker brown, as are also posterior tibiae and tarsi; posterior femora with long, fine, pale yellow, stiff hairs on all sides except above; posterior tibiae with much shorter and more or less normal pubescence.

Wings rather dark brown, with clear parts as follows: from base nearly up to anterior cross-vein (except for a narrow dark streak from tip of anal cell to hind margin of wing); a median transverse row of three clear spots, of which upper and lower ones are as in *T. sexguttata*, middle one being squarish, its upper edge just overlapping inner edge of upper spot, and its lower edge narrowly separated from lower spot by posterior cross-vein; an apical clear band as in *T. sexguttata*. *Halteres* yellowish.

Described from an unique specimen in the British Museum from Siam, 10. i. 1902 (*Robinson and Annandale*).

Diopsis anthracina, sp. n.

Sex (?).—Cape. Long. 5–5.5 mm.

Head reddish orange, viewed from in front distinctly wider above than below; transverse black vertical line rather broad; ocellar spot small, black; eye-stalks rather short, stout, about as long as from neck to hind margin of thorax. A vertical spine in place of usual vertical bristle; eye-stalk also ending apically in a strong black spine. Antennæ black, arista long. Face gently convex, facial teeth moderately strong; mouth-parts black.

Thorax, including neck and scutellum, shining black; spines brownish orange to dark brown.

Abdomen elongate, shining black, unmarked, more than one and a half times as long as thorax, gradually widening from base to nearly twice breadth of latter at widest part.

Legs dark brown to black; fore femora only slightly thickened, on underside with a double row of fine teeth on less than apical half; posterior femora with distinct apical spines.

Wings grey, a little darker along third and fifth veins, also at tip; costal, subcostal, and basal parts of first basal and discal cells quite clear. *Halteres* whitish.

Described from five specimens from South-West Africa (Waterberg), and one, the type, from Durban (Natal), x. 1920 (*C. v. d. Merwe*); all the examples, except the type, which is in the South African Museum, Cape Town, are in indifferent condition.

Diopsis maculithorax, sp. n.

♂.—W. Africa (Gabon). Long. 8 mm.

Head, viewed from in front, nearly twice as broad above as below; vertex and frons somewhat flattened, face prominent in middle, eye-stalks rather stout, about as long as from neck to tip of scutellum; facial teeth strong. Head wholly red-orange; transverse line and a vertical median facial line, the small ocellar spot, tip of eye-stalks and their apical spines black. Antennæ orange, a little grey-dusted; arista black, basal part orange. Vertical bristle normal (broken off in case of type), face with some scattered whitish hairs.

Thorax.—Neck shining black; dorsum moderately dark ash-grey, a dark brown median stripe with two moderate-sized spots on each side, one before and one behind suture; latter and humeri demarcated by deeply impressed lines; scutellum red-orange, spines rather long, tips and a small spot before their middle, black. Pleuræ and metanotum darker grey. Whole thorax, including scutellum and spines, with some short, scattered, whitish hairs.

Abdomen nearly one and a half times as long as head and thorax (including scutellum), gradually widening to tip of third segment, where it is twice as wide as at base, thence narrowing, wholly red-orange with some fine outstanding hairs along sides. Venter uniformly yellowish-grey dusted.

Legs orange; fore femora strongly incrassate, apparently with usual teeth below, but no bristles; soft whitish hair on upper, outer, and under sides; fore tarsi blackish, with bright yellow pubescence below; posterior femora with distinct apical spines.

Wings moderately dark grey, a little more yellowish in front. *Halteres* whitish.

Length 8 mm.

Described from a solitary ♂, in perfect condition, in the Paris Museum from the R. Ogowe (Lambarene), Gabon, 1913 (R. Ellenberger). This species has a general resemblance to *D. thoracica*, Westw., and to *Teleopsis sulcifrons*, Bezzi.

Diopsis flavoscutellata, sp. n.

Sex (?).—French Guinea. Long. 8 mm. (estimated).

Structurally distinct from *D. maculithorax*.

Head, seen from in front, with nearly parallel sides, instead of being conspicuously broader above than below; transverse line is brownish and indistinct, facial median line absent, face as prominent as in *D. maculithorax*, but entire head practically bare. Neck dull black, with a little greyish dust.

Thorax yellowish-grey dusted, except on blackish humeri; scutellum and spines ochraceous, no tinge of reddish orange. Pleuræ ash-grey.

Abdomen pale yellowish, a little more brownish at base (fifth and sixth segments missing in case of type).

Legs yellowish, fore femora less incrassate than in *D. maculithorax*, fore tibiæ dark brown, all tarsi brownish.

Wings pale yellowish grey.

Length about 8 mm.

Described from a single specimen of uncertain sex in the Paris Museum from Mamou, French Guinea, 1913 (E. Roubaud). This species might easily be mistaken for a slightly smaller and pale variety of *D. maculithorax*, but the shape of the head and the less incrassate fore femora clearly distinguish it. It is possible that it should be referred to *Diasemopsis*, but there is no sign of scutellar spinal, postalar, or notopleural bristles.

Diopsis apollo, sp. n.

♂.—Madagascar. Long. 7 mm.

Wholly light reddish orange.

Head with a curved black line on anterior margin of frons and the small ocellar spots black. Eye-stalks more brownish, about as long as from frons to tip of scutellum; vertical bristle at about their middle. Head in profile moderately convex. Facial teeth absent, but lower corners of head sharply angular.

Thorax : scutellum barely broader than long.

Abdomen distinctly longer than head and thorax together, subcylindrical, widening somewhat very gradually towards tip.

Legs : fore femora strongly incrassate, usual teeth below apparently present ; a small black spot at tip on under side reaching to upper and inner sides.

Wings pale brown, approximately basal third nearly clear ; a rather small, squarish, nearly clear spot on costa beyond middle, reaching to third vein, with similar spot opposite to it on hind margin, contiguous to outer side of discal cell ; a nearly clear, slightly curved subapical band. *Halteres* very pale yellowish.

A very handsome species. The type is a solitary well-preserved specimen in the Paris Museum from Diego Suarez, 1901 (*H. Donckier*).

Diasemopsis longipedunculata, sp. n.

♂ (?).—Uganda. Long. 8 mm. : expanse of eye-stalks 12.5 mm.

Head considerably broader above than below ; face distinctly convex, facial teeth strong ; eye-stalks distinctly longer than abdomen (about 5 mm. to 6 mm.), very slender, nearly straight and much more divergent than usual ; vertical bristle distinctly before middle of eye-stalk itself, apart from eye ; no obvious spine at tip of eye-stalk. Head all reddish orange except usual black transverse line, deep black tips of eye-stalks, and blackish ocellar spot.

Thorax blackish brown, neck very shining black, with a tinge of violet in certain lights ; a little greyish dust just noticeable on lower part of pleuræ, with a little sparse pubescence. Scutellum concolorous with scutum, spines dark brown (one missing in case of type), no apical bristle present but postalar bristle distinct ; also another bristle which may be the post-humeral, although set rather far back. A notopleural bristle distinct.

Abdomen dark brown, nearly cylindrical but gradually widening to tip of third segment.

Legs brownish orange ; fore femora only slightly and uniformly thickened ; usual teeth below, as also a row of moderately strong bristles and longer soft hairs. Fore tibiæ blackish at tips ; first segment of fore tarsi dark brown, remainder of fore tarsi yellowish. Posterior femora with a little long, soft, pale hair arranged in three rows, approximately one row on upper and two rows on under side.

Wings very pale grey ; yellowish brown from third vein hindwards to margin of wing, extending to proximal side of anterior cross-vein and broadly to wing-tip. *Halteres* pale yellowish.

Described from a solitary specimen in the British Museum from the Uganda Protectorate (Mabira Forest, Chagwe), 3500–3800 ft., 16–25. vii. 1911 (*Dr. S. A. Neave*).

The most conspicuous character of this species is the great length of the eye-stalks, which are longer than in any other known to me. Although the type no longer has an apical bristle on its one remaining scutellar spine, the presence of the postalar bristle (strengthened by the addition of two other bristles) makes it almost certain that the species is a *Diasemopsis*. It has also the facies of this genus.

Diasemopsis apicifasciata, sp. n.

♀.—Ashanti. Long. about 6.5 mm.

Head a little broader above than below, face moderately convex, lower corners rounded off, but slightly angular and without anything in the nature of even a tubercle or peg. Whole head brownish orange, except black transverse line, large brown labella, and black tips to eye-stalks, which end in a prominent spine on upper side. Eye-stalks barely longer than from frons to tip of scutellum ; vertical bristle long and strong, situate as usual ; antennæ brownish orange, arista long, black.

Thorax dull black, neck shining black, pleuræ with traces of greyish dust, dorsum rather ochraceous-brown, scutellum concolorous, spines mahogany-brown with short apical bristles. Postalar bristle long and conspicuous (notopleural not evident), some stiff short hairs in dorso-central region.

Abdomen blackish brown ; first segment very short, black with extremely narrow whitish hind margin ; second segment fully as long as third and fourth segments together, with a slight contraction about middle, where there is a pale bluish-grey moderately wide band (thus giving appearance of a junction of two segments), band widening slightly towards extreme sides. Second and third segments with hind margins very narrowly pale ; anterior angles of third and fourth segments each with a triangular blue-grey dust-spot. Fine, stiff, pale outstanding hairs along sides of abdomen. Ovipositor inconspicuous.

Legs mainly orange-brown ; fore femora moderately and uniformly incrassate, with usual rows of teeth on a little more than apical half ; two rows also of long, well-separated

hairs on underside, with some additional hairs on outer side. Fore tibiæ and tips of posterior femora broadly black or blackish; fore tarsi brown. Posterior femora with long fine hairs below, mostly arranged in well-separated rows.

Wings pale yellowish grey; a central, moderately dark yellowish-brown infuscation over third vein from just before anterior cross-vein to about opposite tip of discal cell; a similar infuscation covering about same distance on fifth vein, and an infuscation also in upper distal angle of discal cell, the whole making a tolerably uniform infuscated space in middle of wing. An apical infuscation extending from a little before tip of second to a corresponding position on fourth vein, the colour spreading inwards along third vein for some distance but ending well clear of the central suffusion; fifth vein ending abruptly some distance from wing-border. *Halteres* whitish.

Described from a single specimen in the British Museum from Ashanti (Obuasi), 17. viii. 1907 (Dr. W. M. Graham), "caught near stream."

The principal character exhibited by *Diasemopsis apici-fasciata* is the wing-infuscation, which is more extensive and conspicuous than in most species of this genus.

Diasemopsis fuscipicis, sp. n.

♂ ♀.—West Africa. Long. 5 mm.

Head barely wider above than below, a little higher than wide; vertex and frons not well separated from face; head (except eye-stalks) wholly black, therefore no transverse line present. Eye-stalks in ♂ as long as abdomen, in ♀ a little shorter and stouter, orange-brown, tips black with distinct spine; eyes dull red, with greyish dust. Vertical bristle normal, ocellar tubercle small. Face gently convex in profile; lower corners with rounded angles, a little more conical in ♀.

Thorax.—Neck shining black; dorsum and pleuræ less shining black; scutellum somewhat grey-dusted, spines long, straight, black, apical bristle distinct.

Abdomen black, shining; in ♂ narrower than thorax, a little longer than from frons to tip of scutellum, only slightly widening from base to tip of third segment; in ♀ a little shorter, more clavate, as wide at widest part as thorax. In ♂ and ♀ a band of grey dust over tip of first segment and base of second; second segment with a fair-sized, blue-grey, oblong, transverse spot on each posterior angle, their lower inner corners contiguous to each other on

hind margin; third segment with a similar pair of spots; fourth segment dark grey-brown, with a small grey spot across each front angle and a blackish central spot; fifth and sixth segments dark grey-brown. Venter blackish, with paler transverse marks. Spots in ♀ a little larger and more separated.

Legs brownish yellow; fore coxæ pale yellow, posterior coxæ blackish; fore femora more orange-yellow, usual teeth below and two rows of spines on apical part, four spines in inner, three in outer row. Fore tibiæ and first segment of fore tarsi black, rest of fore tarsi whitish. Posterior femora more or less streaked apically with brown.

Wings nearly clear, a blackish-brown apical spot reaching from second to fourth veins, very distinct apically but dying away on inner side. First posterior and discal cells with extremely faint brownish infuscation. *Halteres* whitish.

Length 5 mm.

Described from one ♂ from Cameroon (Région de Dchang), 1400 metres, volcanic plateau, xii. 1923 (*Dr. Gro-mier*); and one ♀ from Gabon (R. Ogowe, Lambarene), 1913 (*R. Ellenberger*). In the ♀ the wing is just a shade more infuscated, and the apical spot a little more extensive. Types in Paris Museum. Distinctly allied to my *Diasemopsis apicifasciata* and *D. apicinotata*, but distinguishable from both by its black head.

Diasemopsis sexnotata, sp. n.

Sex (?).—Ashanti. Long. about 7.5 mm.

Head of normal shape; face with rounded lower angles, considerably convex; vertex slightly sunken, enclosing conspicuous, elevated, elongate, concolorous callus. Eye-stalks longer than from front of head to tip of scutellum, very divergent, slender, ending in distinct fine apical spines on upper side. Head uniformly brownish orange except the transverse vertical stripe, small ocellar tubercle and black tips to eye-stalks. Vertical bristle normal.

Thorax blackish; neck moderately shining black, dorsum yellowish-brown dusted; pleuræ a little greyish dusted; scutellum and spines orange-brown. Postalar bristle strong.

Abdomen gently clavate from base, one and a half times broader at tip of third segment than at base; second segment more than twice as long as first, a little longer than third; whole abdomen orange-brown, dorsum of basal half blackish in parts. On second segment two distinct grey dust-spots, diagonally placed, their anterior ends confluent in middle

line near front margin ; a more or less oblong spot on each side of hind margin ; third segment with similar spots on hind margin, each spot with an indistinct forwardly-directed prolongation. Genitalia mainly concealed.

Legs rather pale orange-brown ; fore femora very incrassate, a streak on inner side at base and on outer side at tip, usual teeth below and a row of four or five spines below towards inner side. Front tibiae and first segment of front tarsi darker brown.

Wings uniformly yellowish grey, tips rather broadly brownish infuscated. *Halteres* yellowish.

Described from a solitary specimen in the British Museum from Ashanti (Obuasi), 21. vi. 1907 (*Dr. W. M. Graham*). The six small grey abdominal spots (seen best at a low angle from behind) form the most conspicuous character of the species ; the long eye-stalks, distinctly infuscated wing-tips, and small elongate callus on the vertex are also distinctive.

XXXIV.—*The Godman-Thomas Expedition to Peru.*—VIII.
On Mammals obtained by Mr. Hendee at Pebas and Iquitos,
Upper Amazons. By OLDFIELD THOMAS.

AFTER a short stay at Iquitos, where he collected a certain number of mammals, Mr. R. W. Hendee stopped long enough at Pebas to make a really considerable collection there—and a very valuable one it has proved to be. In spite of the locality having been long mentioned in zoology, we really have comparatively few specimens from Pebas, and this collection shows that it is a most interesting place, possessing quite a number of species hitherto supposed to be confined to the Ucayali and Huallaga regions of the Peruvian Amazons. Several have proved to be new, and others have greatly helped in clearing up our knowledge of the mammalogy of the Upper Amazon.

The two localities Pebas and Iquitos are alone represented in this collection, the river at the former being at about 330 feet and the latter 350 feet in altitude.

The collection consists of about one hundred and twenty specimens, belonging to thirty-five species and subspecies, and is again characteristic of Mr. Hendee's skill in obtaining rare and interesting mammals, and in so preparing his skins that their admirable preparation and careful labelling make them a pleasure to work with.

The most interesting novelty is the fine spiny rat *Echimy's rhipidurus*, while new subspecies of *Mystax* and *Diæmus* are also described. A new *Cyclopes* from Buena Vista, Bolivia, has also been brought to light by the study of Mr. Hendee's series.

1. *Pithecia monachus*, Humb.

♂. 1611. Pebas, 300'.

2. *Callicebus leucometopa*, Cabr.

♂. 1552; ♀. 1535. Iquitos.

Should probably be considered as a subspecies of *C. cupreus*.

3. *Aotus* sp.

♀. 1604 (young). Pebas.

4. *Mystax lagonotus*, Espada.

♂. 1554; ♀. 1539, 1555. Iquitos, 400'.

These very handsome marmosets belong to a species we have hitherto had in the collection under the name of *M. illigeri*, a determination accepted by Dr. Elliot. But they do not appear to be rightly referable to the true *M. illigeri* of Pucheran, which is especially described as having the inner sides of the fore limbs and the under surface of the body red, while these parts are black in the present animal.

But *M. lagonotus*, Espada, appears to fit them very well, the description agreeing closely, as does an excellent drawing of the type kindly sent me by Sr. Cabrera. The type-locality was Coca, on the Rio Napo, and besides the present specimens we have examples from Alpayacu, Rio Pastaza, and from the Copataza River, all being in the Oriente of Ecuador.

5. *Mystax nigricollis*, Spix.

♀. 1560, 1574. Pebas.

6. *Mystax nigrifrons pebilis*, subsp. n.

♂. 1602, 1606, 1607, 1649; ♀. 1603. Pebas.

Like *M. nigrifrons* as described by Geoffroy, but the sides of the face are black, and this colour extends backwards along the sides of the neck to the shoulders as a narrow black line above the ears and broadly below them; the throat and chest also black, only taking on a grizzled fulvous character on the belly.

Dimensions of the type:—

Head and body 219 mm.; tail 326; hind foot 63·5.

Skull: greatest length 46.

Hab. Pebas.

Type. Adult male. B.M. no. 28.7.21.12. Original number 1607. Collected 6th February, 1928.

This marmoset, represented by five excellent specimens, I at first thought ought to be looked upon as only subspecifically distinct from *M. devillei*, with which I still think it may later be found to intergrade. But *nigrifrons*, whose name has priority over *devillei*, is described as having the most marked characteristic of the Peba marmoset—the extension of the grizzled olivaceous of the mantle on to the top of the head between the ears, an arrangement which readily separates the animal from all races of *devillei*, so far as known. But it is impossible to assign it to the typical *nigrifrons*, for Geoffroy distinctly states* that that animal, whose exact locality was unknown, had the sides of the face and neck grizzled olivaceous like the mantle and crown, while the broad extension backwards to the shoulders, above and below the ears, of the black of the cheeks is highly characteristic of the Peba marmoset. Moreover, *nigrifrons* has the throat, neck, and nearly all the under surface grizzled olivaceous or rufous, these parts being black in *pebilis*.

M. nigrifrons nigrifrons remains, therefore, only known from the unlocalized type in Paris, the individual from the Javari mentioned by Schlegel being not impossibly an example of *M. n. pebilis*.

7. *Cebuella pygmaea*, Spix.

♂. 1573; ♀. 1636, 1637. Pebas.

8. *Thyroptera discifera*, Licht.

Eight from Iquitos, 400'.

9. *Saccopteryx leptura*, Schr.

♂. 1571. Pebas.

10. *Noctilio leporinus*, L.

Ten from Pebas.

11. *Molossus obscurus*, Geoff.

Five from Pebas.

* Arch. Mus. v. p. 572 (1851).

12. *Tonatia amblyotis*, Wagn.

♂. 1613; ♀. 1634 (in al.), 1635. Pebas.

13. *Anthorhina crenulata*, Geoff.

♀. 1640 (in al.), 1641, 1642. Pebas.

14. *Carollia perspicillata*, L.

Six from Pebas.

15. *Glossophaga soricina*, Pall.

♂. 1570. Pebas.

16. *Artibeus planirostris*, Spix.

Eight from Pebas.

17. *Vampyrops carhinus*, H. All.

♀. 1639. Pebas.

18. *Dicemus youngi cypselinus*, subsp. n.

♀. 1575. Pebas, 300', 28th January, 1928. B.M. no. 28. 7. 21. 64. *Type*.

General characters, including coloration of fur and membranes, as in true *D. youngi*, but the wings more elongate terminally.

Size slightly greater than in *youngi*, the forearm 56 mm. as compared with 53 mm. in the largest of our five specimens of *youngi*. Digits more elongate, the first three segments of the third digit respectively 55, 11, and 30 mm., as compared with 50, 10, and 27 mm. in Jentink's type, these dimensions being essentially the same in our S.-Brazilian specimens, in which the second phalanx attains at most 26 mm., the lengthening of this phalanx having the most influence in the general lengthening of the wing. The whole of the third digit, including the vaguely defined third phalanx, therefore attaining about 115 mm., as compared with about 100 mm. in equally aged specimens of *youngi*. The tip of the wing extends just on 60 mm. behind the elbow, as compared with 48-50 mm. in *youngi*. Feet apparently rather longer and more stoutly built.

Skull of type: greatest length 25.8 mm.; breadth of brain-case 13.5.

Hab. and type as above.

Dr. Knud Andersen has found reason to attach so much importance to the relative lengths of the digits in bats that, in view of the great difference in locality, I think the Peruvian representative of *Diæmus* should be considered as a special western subspecies. Jentink's type came from British Guiana, while our Museum contains a set of five examples from Parana, S. Brazil, collected by A. Robert, and all agreeing in the lengths of their wings with the Guianan form.

In any case, this is a valuable accession, as *Diæmus youngi* appears to be an excessively rare bat, of which the only recorded examples are the type, those collected in Parana by A. Robert (one of these being also in Washington), and now the present specimen, captured by Mr. Hendee "in house in evening" at Pebas.

19. *Potos flavus*, Schr.

♀. 1537, 1538. Iquitos, 400'.

20. *Sciurus (Hadroskiurus) igniventris*, Wagn.

♂. 1553, 1569, 1609, 1610, 1650; ♀. 1598, 1599. Pebas, 300'.

♂. Iquitos, 400'.

A most interesting series, both as showing the variation towards melanism that occurs in these squirrels, and as finally settling the identification of two of Gray's names—*S. fumigatus* and *brunneoniger*,—both described on more or less melanistic specimens from the Castelnau collection.

Four of the seven specimens are in the full red and yellow coloration, then a fifth is darkened on the back and feet but still rufous on the hips; to this follows no. 6, still darker, with black feet, and, finally, no. 7 is blackish throughout, with merely a little grizzling on the shoulders and flanks. They thus form a complete series from one extreme to the other. Then on comparison we find that the type of *brunneoniger* is exactly like that here called no. 5, and that of *fumigatus* is equally exactly like no. 7, so that the doubts that still existed as to the identification of these names, as shown in Dr. Allen's Monograph*, are now finally dispelled—that is to say, they prove that nos. 1–4 are to be treated as the normal form of the squirrel, and the melanistic tendencies of certain specimens may be completely ignored.

But what the species, in its normal reddish form, is to be

* "Review of South American Sciuridae," Bull. Am. Mus. xxiv. p. 269 (1915).

called I am still doubtful about, so great is the variation that occurs in all this group of squirrels. And I therefore provisionally use the earliest name available—*S. igniventris*,—which antedates *S. tricolor* by three years. On the whole, the Pebas squirrel is most like the subspecies I described as *S. i. fulminatus* from the Lower Rio Negro.

Not only the colours, but the skulls of these squirrels are highly variable, this series embracing some of the very long-muzzled form and others of more normal shape. Naturally these differences have been supposed, both by Dr. Allen and myself, to be of decided systematic value, although I did venture to cast a slight doubt upon them when last writing on the group*. I am now satisfied that, unlike cranial characters in mammals generally, they are almost of no value at all.

While accepting Dr. Allen's "genera" of S.-American squirrels as subgenera of *Sciurus*, I find it quite impossible to consider what he calls *Hadrosciurus*, based on *S. flammifer*, as distinct from *Urosciurus*, type *S. tricolor*. This being the case, owing to the unnoticed accident of his having described *Hadrosciurus* before *Urosciurus*, it is the former name which should be used for the S.-American giant squirrels, and not the latter, as I regret that I have done till recently, and I therefore now make the necessary alteration.

21. *Microsciurus flaviventer*, Gray.

♂. 1577, 1578; ♀. 1576, 1582, 1653. Pebas.

A very uniform series, agreeing, *inter se*, with the type, collected by Castelnau in this region, and with another specimen from Pebas obtained by Mr. Mounsey, in their general colour, their strongly yellowish under surface, their yellowish postauricular patches, their three pairs of mammae, their naked soles, and their possession of *p*³.

On the other hand, such small brown squirrels as we have from the Lower Negro and Manaos region—including the type of *manarius*—are most puzzlingly variable in these and other characters, and I do not at present venture to express any decided opinion about them.

At Mazan, between Iquitos and Pebas, Sr. Olalla obtained a squirrel like *M. manarius*, with a very small skull and no *p*³.

22. *Sciurillus pusillus*, Desm.

♂. 1560; ♀. 1579. Pebas, 300'.

This is the first definite record of the S.-American pygmy

* Ann. & Mag. Nat. Hist. (9) xvii. p. 636 (1926).

squirrel on the Upper Amazons, although we may now presume that the type of *S. kuhlii*, Gray, which was said to have been collected by Castelnau, was in all probability obtained there.

23. *Oryzomys laticeps*, Lund.

♀. 1592. Pebas, 300'.

24. *Oryzomys longicaudatus destructor*, Tsch.

♂. 1586, 1600; ♀. 1585. Pebas, 300'.

25. *Isothrix villosa*, Dev.

♂. 1651; ♀. 1608, 1638, 1652.

The two adult specimens of this set, like the examples of *I. m. molliæ* obtained at Masisea on the Ucayali by Mr. Rutter, have no black patch on the back, such as is described in the type of *villosa*, and its absence induced me to describe *molliæ* as distinct. But the young specimens 1651 and 1652 have a darkening in the dorsal region, which would seem to indicate that the character may be one of age, and in any case is not one on which a distinction can be based. Pebas is below Sarayacu, the type-locality of *villosa*, while Masisea is above it, so there can be little doubt that the two separated forms are the same. It is also not impossible that *villosa* will prove to grade into the Rio Negro *bistriata*, of which it would form an Upper-Amazon subspecies. The Museum now possesses sixteen specimens of these two related forms.

Señor Olalla also obtained a specimen of this animal above Pebas, at the mouth of the Rio Mazan.

26. *Echimys rhipidurus* *, sp. n.

♂. 1566. Pebas, 300'. January 25, 1928. B.M. no. 28. 7. 21. 89. *Type*.

In general appearance very like *E. armatus*, with the same hispid semi-spinous fur (though the spines are less broad), the same general colour, coarsely lined greyish buffy anteriorly, more strongly buffy posteriorly, the same ochraceous muzzle, the same dull greyish under surface, and the same grey feet, which are, however, more stoutly built. Size slightly greater. But the tail is absolutely distinctive, grizzled ochraceous for the basal 2 inches, then well clothed to the end with glossy black hairs, practically hiding the scales, in marked contrast to the naked scaly tail of *E. armatus*, and of the same

* *I. e.*, with the tail of a *Rhipidomys*.

character, though less strongly marked, as the splendid glossy black tail of *E. grandis*. The fur of the basal 2 inches hispid, but not so strongly spinous as in *armatus*.

Skull not unlike that of *E. armatus*, but rather larger, with a longer muzzle, the nasals longer and more narrowed behind. Supraorbital ledges well developed. Bullæ about as in *armatus*.

Fur of body, though looking very much the same, less strongly spinous than in *armatus*, and there are none of the fine yellow tips to the spines which are generally present, and often very conspicuous, in that animal.

Dimensions of the type:—

Head and body 240 mm.; tail 203; hind foot 37·5; ear 16.

Skull: greatest length 55·5; condylo-incisive length 49·5; zygomatic breadth 26·5; nasals, length 18, breadth at middle point 5; interorbital breadth 14·3; upper cheek-tooth series 14.

Hab. and type as above.

Among the few and well-marked species of *Echimys* this fine animal is well characterized by its hairy black tail, its ally *E. armatus* having this organ scaly and naked, as has Anthony's *E. longirostris*, of whose distinction from *armatus* I have some doubt.

The Western Ecuador *E. occasius* also has the scaly tail and yellow-tipped spines of *E. armatus*.

27. *Proechimys brevicauda*, Günth.

♂. 1550. Iquitos, 400'.

Fourteen specimens from Pebas.

As usual, owing to their variability, the specimens of *Proechimys* present a problem far from easy of solution. Thirteen of the fifteen specimens have pure sharply defined white bellies, the other two showing a tendency towards the buffy belly which occurs in the type of *brevicauda*. One individual—no. 1588—is as large as the type of *P. hilda*, the others being of the size of ordinary *brevicauda*.

On the whole, it seems best to call them all by Günther's early name.

The present is an extension down the Amazon of this type of *Proechimys*, so common on the upper river.

28. *Dasyprocta fuliginosa*, Wagl.

♀. 1536 (yg.). Iquitos, 400'.

29. *Myoprocta pratti*, Poc.

♂. 1551. Iquitos, 400'.

30. *Cholæpus didactylus*, L.

♀. 1605. Pebas.

31. *Cyclopes didactylus ida*, Thos.

♀. 1531, 1549. Iquitos, 400'.

Quite like the original *ida* of Sarayacu Ecuador.

Contrary to what has happened in some other groups where specimens have had of necessity to be determined and named on material which has later proved to be deceptive, the growth of the collection confirms the validity of the two western subspecies of *C. didactylus* founded in 1900 and 1902, and gives us some knowledge of the geographical distribution of the different forms.

True *C. didactylus*, grey, with a very long greyish white-tipped tail, both upper and lower dark streaks present, occurs in Guiana and Eastern Amazonia to Pernambuco.

C. d. ida, short-tailed, with slight dorsal and no sternal streak; Eastern Ecuador, Upper and Middle Amazon down to the Tapajoz, where Fräulein Snethlage obtained a very typical specimen.

C. d. eva, yellowish, dorsal and sternal streaks present but only slightly indicated; Bogota, down west of the Andes, through Western Columbia to Western Ecuador.

Then from quite a different geographical area we have the following new subspecies:—

Cyclopes didactylus catellus, subsp. n.

Tail comparatively short, markedly shorter than in the long-tailed *didactylus*. General colour very yellowish, the body greyish yellow, tail and limbs deep yellow. No dorsal dark streak, but a broad and strongly developed sternal one running to the inguinal region. Fur very thick and soft, that on the base of the tail so long as to give that organ an unusually conical shape.

Dimensions of the type:—

Head and body 180 mm.; tail 205.

Skull; greatest length 53; breadth 24.

Hab. Santa Cruz region of Bolivia. Type-series from Buenavista, 500 metres.

Type. Adult female. B.M. no. 26.1.12.17. Original number 1481. Collected 8th August, 1924, by J. Steinbach. Five specimens, four adult and one young.

A very distinct form, represented by a good uniform series. The sternal and ventral black streak more developed than in any other race, although anteriorly, on the throat, it is broader in *didactylus*.

The young specimen is coloured quite like the adults.

32. *Metachirus opossum andersoni*, Osg.

♂. 1533 (yg.), 1534; ♀. 1532. Iquitos, 400'.

Type-locality Yurimaguas, Lower Huallaga.

Readily distinguishable by the contrasted black back and grey sides.

Since my paper on new subspecies of this group was published we have received good series of both *M. o. canus*, Osg., from the typical region (Moyobamba, Yurac Yaku, &c.) and from the Ucayali, as well as others from Buena Vista, Bolivia, representing *M. o. crucialis*, and I now think that these two forms should not be considered as distinct from each other.

33. *Metachirus nudicaudatus*, Geoff.

♂. 1587, 1593, 1601. Pebas.

Very like specimens from Para and Pernambuco, in spite of the immense distance from these localities. No darkened dorsal area.

34. *Marmosa rutteri*, Thos.

♂. 1612. Pebas.

35. *Marmosa noctivaga*, Tsch.

♂. 1583, 1584 (yg.). Pebas.

On the ground of locality these achocayas may be supposed to represent Mr. Osgood's Yurimaguas *M. impavida neglecta*, on whose distinction from *M. noctivaga* I had already thrown some doubt. Like examples of the last-named from Tingo Maria, on the Huallaga, their under surface is dull whitish, without the buffy which was Mr. Osgood's main reason for distinguishing *neglecta*. The skull of 1583 is 41 mm. in length and has the parallel supraorbital ridges so characteristic of *noctivaga*.

XXXV.—*The Non-Marine Vertebrate Fauna of the New Hebrides.* By JOHN R. BAKER, M.A., D.Phil. (Oxon.).

(From the Department of Zoology and Comparative Anatomy, Oxford.)

In this paper I present a list of the non-marine vertebrate fauna of the New Hebrides. The list was prepared by the authorities at the British Museum of Natural History from three sources—namely, (1) specimens already in the Museum,

(2) published records, and (3) my own collections made during my visits to the New Hebrides under the Percy Sladen Trust in 1922-3 and 1927. My collections of vertebrates have been presented to the British Museum.

I wish to thank the Percy Sladen Trustees and Mrs. G. E. Baker and Mr. S. J. Baker for providing part of the funds necessary for my investigations; the Colonial Sugar Refining Company, of Sydney, for most courteously giving me all the alcohol I required for the preservation of specimens; Mr. and Mrs. W. Anderson, Mr. T. O. Thomas, the Rev. R. E. Tempest, and the British Resident Commissioner for a great deal of help while in the islands; and my assistant, Mr. J. de H. Morel, for his valuable work in collecting, skinning, etc.

My specimens were worked out and the lists prepared by Mr. Oldfield Thomas (Mammals), Mr. N. B. Kinnear (Birds), Mr. H. W. Parker (Reptiles), and Mr. J. R. Norman (Fishes), who also most kindly gave me much information which was of help in writing the notes on each class.

The New Hebrides, in which I include the Banks Islands, are an archipelago of mountainous islands in the western Pacific Ocean, consisting mostly of volcanic and coral rock with some sedimentary strata extending back to the Miocene. The climate is tropical, with heavy rainfall, and all the islands except the most southerly are clothed over nearly the whole of their surface from high-water mark to the tops of the mountains with luxuriant forest vegetation. The fauna is a typical one for a group of islands which has never been close to a large land-mass.

MAMMALS.

The mammalian fauna is a particularly characteristic one for a group of oceanic islands, for excluding the feral pig there are only bats and rats. There are no fewer than five species of fruit-bats, including an example of the remarkable tailed genus *Notopterus*, which is confined to New Guinea and Western Oceania. Three of the four species of *Pteropus* are found nowhere outside the New Hebrides—rather a curious circumstance in a group of animals gifted with flight. The new species (*Pt. bakeri*) was described by Mr. Oldfield Thomas (6). The latter also thinks that my *Pt. eotinus*, from Espiritu Santo, may be subspecifically distinct from the type-specimens from Maewo; but there are not sufficient specimens from Maewo to determine the point. The two insectivorous bats have not previously been recorded from the New Hebrides.

Rattus rattus was no doubt introduced into the islands by shipping.

The pig (*Sus papuensis*) was probably brought to the islands by the natives when first they came to them. They are mentioned by Captain Cook (3). In addition to the domesticated ones, many are feral. In certain of the islands, notably Espiritu Santo and Gaua, quite a large proportion of the domesticated pigs (and of the wild ones also, according to native report) are intersexual, having external organs varying from almost the female to nearly the male condition, and more or less ill-developed male internal organs. They constitute a new type of mammalian intersexuality; for in the rare cases in which an intersex is recorded in other parts of the world, some vestiges at least of the uterus and vagina are nearly always found, whereas in the New Hebridean intersexes there is no trace of any female internal organ. Nowhere in the world is any mammalian intersex so abundant. I once counted no fewer than 125 intersexes in one day at Hog Harbour, Espiritu Santo, when the natives were exchanging young intersexes for big ones brought from another island. These monstrosities play a large part in the social life of the natives, being of especial importance in chief-making ceremonies. I have already alluded to them in two publications (1 & 2), and I propose to give a full account of them at a future date.

The natives remove the upper canines of both males and intersexes, thus allowing the lower canines to grow indefinitely. A complete circle is formed in perhaps eight years, the point of the tooth often entering the bone alongside its own root. Sometimes considerably more than a circle is formed.

BIRDS.

Essentially the bird-fauna is Australian. Representatives occur of such characteristically Australian groups as the Mound-builders (Megapodidæ), Brush-tongued Parrots (Trichoglossidæ), Wood-Swallows (Artamidæ), and Honey-eaters (Meliphagidæ). Flycatchers (Muscicapidæ) and Pigeons (Columbiformes), which are well represented in Australia, though, of course, very far from being confined to that continent, are well represented in the New Hebrides, which further agree with Australia in the absence of Finches (Fringillidæ) and Woodpeckers (Picidæ).

The chief difference from Australia is the absence of several groups which are characteristic—namely, the Cassowary and Emu (Casuariiformes), Lyre-birds (Menuriformes),

Bower-birds (Ptilonorhynchidæ), Cockatoos (Cacatuidæ), and true Parrots (Psittacidæ). *Turdus* (Thrushes), *Erythrura* (Weaver-birds), and *Aplonis* (a genus of Starlings) are genera which are absent from Australia, but occur in the New Hebrides. *Turdus* is, of course, widely distributed outside Australia, while *Erythrura* is a Malayan and *Aplonis* a Polynesian genus.

It is a remarkable fact that of the fifty-three species and subspecies of birds recorded in the list, no fewer than thirty-seven are confined to the New Hebrides.

Rhinochetus jubatus of New Caledonia, the only member of the Heron-like family Rhinochetidæ, has no relative in the New Hebrides.

The little Swift (*Collocalia uropygialis*) is one of the most abundant birds in the New Hebrides. The Pigeons (Columbiformes) are represented by a large number of species, of which *Janthæna vitiensis* and the two species of *Ptilinopus* are probably as common as any. The new Pigeon, *Muskadivora bakeri*, Kinnear (4), seems to be confined to high elevations (above 3000 feet) on the west coast of the island of Espiritu Santo. *Trichoglossus hamatodus*, one of the Brush-tongued Parrots, is often seen flying about in groups, uttering loud screeches. As one walks through the bush one constantly hears the distinctive notes of the Thick-heads (*Pachycephala*) and the familiar song of *Tardus mareensis*. At night the large strand-trees often swarm with little White-eyes (*Zosterops vatesensis*), which sleep in pairs so soundly that they often remain where they are if shot at and missed.

REPTILES.

Lizards.—Fourteen species of Lizards occur, all belonging to the widely distributed families of Geckos and Skinks. The New Hebrides constitute the most easterly point of distribution of three species (*Gecko vittatus*, *Lygosoma cyanogaster*, and *L. kordoanum*). Agamidæ and Varanidæ, well represented in Australia, do not occur. *Brachylophus*, an Iguanid which departs so far from the habit of that essentially American family as to live in Fiji, does not extend to the New Hebrides.

It is a remarkable fact that no fewer than ten of the fourteen species are absent from the adjacent land-mass of New Caledonia. These are *Gehyra oceanica*, *G. vorax*, *Gecko vittatus*, *Lygosoma speiseri*, *L. noctua*, *L. cyanogaster*, *L. samoense*, *L. cyanurum*, *L. kordoanum*, and *L. nigrum*.

L. kordoanum [= *L. lessoni* in Mr. Parker's paper (5)]
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and *L. cyanurum* are probably the most abundant of New Hebridean vertebrates. Everywhere, except in the high mountains, they scuttle before one on one's path. The largest of the *Lygosomas* are *L. samoense* and *L. nigrum*. The former is bright green with black markings above, the latter black with pink below. *L. nigrum* has the curious habit of repeatedly moving the head vertically up and down. *L. samoense* lives in trees, but often drops to the ground when pursued; *L. nigrum*, on the contrary, lives on the ground, but takes to trees to avoid capture. I noticed that the *L. samoense* on Gaua have far more black than those on Efate, and on my return I asked Mr. Parker to examine my material in this connexion. He finds that the Efate specimens have a crescentic black band on the parietals and nuchals, extending forwards on each side to the eye, and only a few scattered black spots on the body, while the Gaua specimens commonly have a black band extending so as to cover almost all the upper surface of the head and nape, while the body has numerous black spots. One Gaua specimen is almost completely black above. The Santo specimens are similar, on the whole, to those of Gaua.

Lygosoma speiseri is the only lizard which is confined to the New Hebrides. The species was named from specimens from Ambrym. My specimens, from Efate, differ from the type ones in having 30-32 (instead of 32-34) series of scales round the body and in having 40-46 (instead of 44-48) subdigital lamellæ under the fourth toe. Further, the pale green dorso-lateral band and the black lateral band may be very indistinct, or the latter may be broken up into irregular dark spots, and the black spots of the dorsal surface and sides may be wanting. In *L. speiseri* and *L. samoense* we seem to see the origin of species consequent on geographical isolation.

Ablepharus boutoni has an extraordinarily wide distribution from Africa across the Indian Ocean to Australia and the South Pacific.

Lepidodactylus lugubris is a little Gecko common in native houses. *Gymnodactylus pelagicus* is only found under stones. The other Geckos frequent trees. *Gehyra mutilata* and *Gecko vittatus* have not previously been recorded from the New Hebrides.

Snakes.—In their snakes the New Hebrides have nothing in common with Australia, for there are no Pythoninæ nor Colubrinæ, and the only genus (*Enygrus*) belongs to a sub-family, the Boinæ, which is essentially American. Although

systematists allow only two species, there are many colour-varieties which have distinct native names. They are perfectly harmless, though viewed with horror (like Geckos) by the natives. I found the remains of what appeared to be a *Turdus mareensis* in the alimentary canal of one specimen. Large individuals attain a length of about 4 feet. I caught one specimen at the height of about 1700 feet on Mt. Turi in Santo.

Crocodiles are extremely rare, but I saw the tracks of a large one on the sea-shore about a mile west of the mouth of the R. Yoro in Espiritu Santo. The natives had seen this animal, but, although I camped close to the spot for some days in the hope of getting a shot, I never saw it. It had made a path for itself, perhaps fifteen yards long, connecting a pond with the sea-shore. Mr. Parker considers that it probably belongs to the species *C. porosus*, which ranges from India through N. Australia to Fiji.

Amphibia are absent as on nearly every oceanic island.

Fishes.—I am not aware that any collection of fresh-water fishes has ever been made before in the New Hebrides*. The list given is simply that of the species obtained by myself. Nearly all of them were obtained near the mouth of the River Yoro (= Jordan), which flows into Big Bay in the Island of Espiritu Santo. This is probably the largest river in the New Hebrides. The water at midstream about half a mile from the mouth at a depth of 1 ft. had the following characters on 29th April, 1927:—Midday temperature 25°·3 C.; pH 8·2; 0·193 gram solid constituents per litre. Most of the fishes were taken with dynamite, while some were shot by natives with bow and arrow.

All the fishes obtained are probably capable of living in the sea. Some of them are known to have this capacity, and the others belong to essentially marine families. This being the case, there is little geographical isolation, and hence no evolution of new species. *Ambassis urotænia*, Bleek., *Querimana crenilabis*, Forsk., and species of *Gobius* and *Sicyopterus* are perhaps the most abundant forms. I sometimes killed fifty or more fishes with a single charge of dynamite.

On approaching the Yoro one day about the end of April 1927, I noticed what appeared to be a large rope lying under the surface of the water parallel to the edge and a few inches from it, extending an indefinite distance up the river

* One eel has been recorded.

from near its mouth. Knowing that there could be no such rope so far from civilization, I investigated it more closely and found it to consist of a mass of little fishes all swimming upstream. These were of the genus *Gobius*, but unfortunately they were too young for the identification of the species.

At Tanavo in central Espiritu Santo I was surprised to find only one species of fish in the large river there. (I think this must be the river which is called Sarakata at its mouth, though I did not have the opportunity to trace it to the sea.) The natives attributed the absence of other fishes to a waterfall further downstream, which they could not pass. The one species which could surmount this obstacle was *Sicyopterus taniurus*, Günth.

In the large fresh-water lake on the island of Gaua the only fishes are eels. I obtained *Anguilla megastoma* from the lake itself and *A. obscura* from the river which flows from it. The eels were identified by Professor Johs. Schmidt.

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LIST OF THE NON-MARINE VERTEBRATE FAUNA OF THE NEW HEBRIDES.

(The species which are confined to the New Hebrides are marked with an asterisk.)

MAMMALS.

- Pteropus geddiei*, MacG.
 *— *eotinus*, K. And.
 *— *aneiteanus*, Gray.
 *— *bakeri*, Thos.
Notopterus macdonaldi, Gray.
Hipposideros cervinus, Gould.
Miniopterus australis, Tomes.
Rattus exulans, Peale.

FERAL.

- Rattus rattus*, L.
Sus papuensis, Less. & Garn.

BIRDS †.

- **Megapodius layardi*, Latham.
Ptilinopus greyi, Gray.
 *— *tannensis*, Latham.

† Shore-birds are excluded.

- **Globicera pacifica farguhari*, Sharpe.
- **Muskadivora bakeri*, Kinnear.
- **Janthænas vitiensis leopoldi*, Tristram.
- *? *Macropygia rufa rufa*, Ramsay.
- **Chalcophaps chrysochlora sandwichensis*, Ramsay.
- **Porphyrio calvus aneileumensis*, Tristram.
- Porzana nigra vitiensis*, Hartlaub.
- Nyroca australis*, Eyton.
- Anas superciliosa*, Gmelin.
- Tyto alba lulu*, Peale.
- Trichoglossus hæmatodus massena*, Bonaparte.
- **Hypocharmosyna palmarum*, Gmelin.
- Lamprococcyx plagosus layardi*, Mathews.
- **Cacomantis prionurus schistaceigularis*, Sharpe.
- **Halcyon julia*, Heine.
- * — *chloris tannensis*, Sharpe.
- * — *hyperpontia*, Oberh.
- * — *farguhari*, Sharpe.
- Collocalia uropygialis uropygialis*, Gray.
- *fuciphaga vanikorensis*, Quoy & Gaimard.
- Hirundo tahitica*, Gmelin.
- **Rhipidura brenchleyi brenchleyi*, Sharpe.
- * — *erromangæ*, Sharpe.
- * — *spilodera*, Gray.
- * — *verrauxi sancta*, Sharpe.
- **Piezorynchus sericeus*, Ramsay.
- **Petræca similis*, Gray.
- * — *ambryuensis*, Sharpe.
- Artamides caledonicus*, Gmelin.
- **Lalage banksiana*, Gray.
- * — *flavocincta*, Sharpe.
- **Pachycephala chlorura*, Gray.
- * — *intacta*, Sharpe.
- **Clytorhynchus pachycephaloides grisescens*, Sharpe.
- * — *vatensis*, Sharpe.
- Artamus melanoleucus*, Forster.
- **Myzomela cardinalis cardinalis*, Gmelin.
- * — *splendida*, Layard & Tristram.
- **Glyciphila notabilis*, Sharpe.
- * — *flavocincta*, Gray.
- **Zosterops flavifrons*, Gmelin.
- *vatensis*, Tristram.
- * — *macgillivrayi*, Sharpe.
- Turdus marensis*, Layard.
- * — *albifrons*, Ramsay.
- *pritzbueri*, E. L. & L. C. Layard.
- **Erythrura serena*, Sclater.
- * — *cyanovirens regia*, Sclater.
- *cyanifrons*, E. Layard.
- **Aplonis rufipennis*, Layard.

REPTILES.

- Gymnodactylus pelagicus* (Girard).
- Lepidodactylus lugubris* (Dum. & Bibr.).
- Peropus oceanicus* (Lesson).
- *vorax* (Girard).
- *mutillatus* (Wiegman).

- Gecko vittatus*, var. *bivittatus* (Dum. & Bibr.).
 **Lygosoma speiseri*, Roux.
 — *noctua* (Lesson).
 — *cyanogaster* (Lesson).
 — *samoense* (Duméril).
 — *cyanurum* (Lesson).
 — *kordoanum* (Meyer).
 — *nigrum* (Hombr. & Jacq.).
Cryptoblepharus boutoni, var. *peronii*, Coct.
Enygrus australis (Montr.).
 — *bibroni*, Hombr. & Jacq.
Crocodylus porosus, Schneid. (?).

FISHES.

- Anguilla megastoma*, Kaup.
 — *mauritiana*, Bennet.
 — *obscura*, Günth.
Microdonophis polyophthalmus, Blkr.
Kuhlia rupestris, Lacep.
 — *humilis*, De Vis.
 — *marginata*, Cuv. & Val.
Therapon argenteus, Cuv. & Val.
Lutianus gembra, Cuv. & Val.
Ambassis urotænia, Bleek.
Carana hippos, Linn.
Gerres filamentosus, Cuv. & Val.
Scatophagus argus, Linn.
Lisa compressa, Günth.
Querimana crenilabis, Forsk.
Agonostomus plicitalis, Cuv. & Val.
Guavina gyronoides, Bleek.
Ophiocara porocephala, Cuv. & Val.
 — *aporos*, Bleek.
 — *macrolepidota*, Bloch.
Gobius sp.
Awaous ocellaris, Brouss.
 — *genivittatus*, Cuv. & Val.
Sicyopterus tæniurus, Günth.

XXXVI.—*Notes on certain African and Madagascan Waterbugs* (Notonectidæ and Corixidæ). By G. E. HUTCHINSON, Department of Zoology, University of the Witwatersrand, Johannesburg.

IN a previous paper (Ann. & Mag. Nat. Hist. (10) i. p. 155 (1928)) an account was given of Notonectidæ taken by my friend Mr. G. L. R. Hancock near Kampala, Uganda. With this material I received from Mr. Hancock a number of Corixidæ, mostly specimens of *Arctocorisa sjöstedti*, Kirk., to be redescribed in another place. In addition to these, there

are three specimens which call for notice here, two being the male and female of a new species of *Arctocoris*a.

Since the publication of my previous paper, there has come into my hands the very important work of Jaczewski (Ann. Zool. Mus. Pol. Hist. Nat. v. p. 62) describing certain species from Dakar, French Senegal. I much regret that residence in S. Africa prevented access to this paper earlier. In consequence, it has been necessary to add certain notes on *Anisops vitrea*, Sign., and other species, given below under Notonectidæ.

Notonectidæ.

1. *Anisops vitrea*, Sign.

Anisops vitreus, Signoret, 1860, Ann. Soc. Ent. Fr.

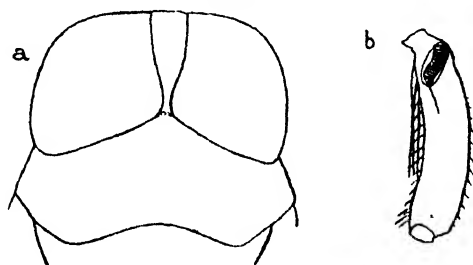
Anisops vitrea, Kirkaldy, 1904, Wien. Ent. Zeit. xxiii.

Anisops persephone, Kirkaldy, 1898, Wien. Ent. Zeit.

Nec *Anisops vitrea*, Jaczewski, 1926, Ann. Zool. Mus. Pol. Hist. Nat. v. 2, p. 88.

In my description of *A. adonis* (l. c. p. 158) I pointed out that in all probability confusion had arisen between *vitrea* and certain other species, and that the occurrence of that

Fig. 1.



Anisops vitrea, Sign., ♂. a, head and prothorax; b, anterior tibia.

species on the continent of Africa was open to question. That this is actually the case is shown by Jaczewski's redescription of specimens of so-called *vitrea*, determined as such by no less an authority than Dr. G. Horvarth, but actually belonging to a new species very closely allied to *adonis*.

To avoid subsequent error, it seems best to figure the head and pronotum (fig. 1) and the anterior tibia (fig. 2) of one of two male specimens of *vitrea*, marked Madagascar, which I received some time since from Staudinger and Bang Haas.

These insects agree with Kirkaldy's description of *persephone*, save in the slightly broader synthlipsis (one-fifth of the vertex instead of one-sixth or one-seventh) and presumably are conspecific with it. *A. persephone* was later synonymized with *vitrea* by its describer. The synthlisses of the African species with which confusion might arise are considerably broader than that of *vitrea*. The facial tubercle of the latter species is flattened and slightly concave. The anterior tibia of the male is about half as long again as the tarsus, which is nearly four times as long as the longer claw. The stridulatory comb is large, more than twice as long as broad, with sinuate sides, composed of about eighteen thin lamellæ. The anterior margin of the tibia bears a row of short, slightly spinous hairs.

2. *Anisops jaczewskii*, sp. n.

Anisops vitrea, Jacz. 1926 (l. c.), nec Sign. 1860 (l. c.).

The specimens described by Jaczewski as *vitrea* appear to be conspecific with a series taken in a pool in the wide sandy flood-bed of the Limpopo River near Messina, N. Transvaal. These belong to a species very closely allied to *adonis*, but differing from it in the shorter anterior tarsus of the male, which is about half as long as the tibia, and in the disposition of the spines along the anterior border of the latter. In *adonis* these lie in the distal two-thirds, in *jaczewskii* in the proximal. My specimens also possess a terminal spine, omitted in Jaczewski's figure, but the agreement is otherwise so close that I have no hesitation in referring the West and South African specimens to one and the same species.

FRENCH SENEGAL: "Dakar, 23. xii. 1921, 2 ♂♂, 1 ♀, pools in the steppe; 2 ♂♂, 1 ♀, pool in the native garden" (*Jaczewski*, l. c.). TRANSVAAL: Limpopo R. near Messina, 28-29. v. 1927 (*G. E. H.*), pool in sandy bed of river, ♂♂, ♀♀ (*type, allotype, and paratypes*).

I have much pleasure in associating this species with the name of Dr. T. Jaczewski, its discoverer and author of many important papers on aquatic Hemiptera.

Corixidæ.

3. *Agraptocorixa* sp.

1 ♀, Kampala, 9. vii. 1926 (*G. L. R. Hancock*).

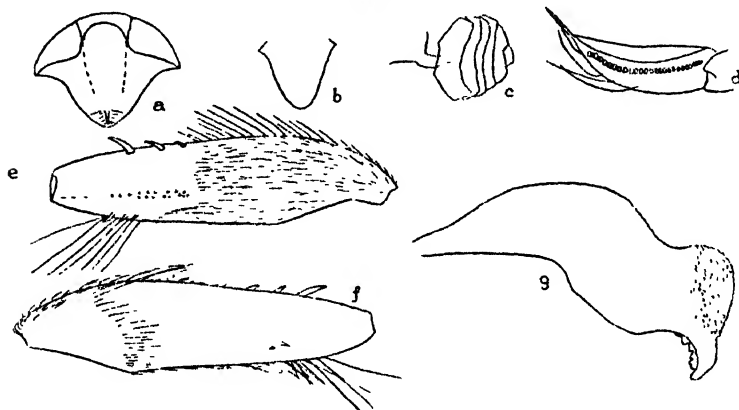
This specimen appears to agree with *A. dakarica*, Jacz.,

save in its slightly smaller size (1.65 mm., *dakarica* as given by Jaczewski 7 mm.). A precise determination without a ♂ specimen is not possible, but since Jaczewski (Ann. & Mag. Nat. Hist. (9) xx. p. 439) records two ♀ ♀ from the Sudan there is nothing inherently improbable in so widespread an insect occurring in Uganda.

4. *Arctocoris chinana*, sp. n.

Head pale yellow; pronotum black with eight pale lines, the third divided into two centrally, the last three tending

Fig. 2.



Arctocoris chinana, sp. n., ♂ type. a, face; b, metaxyphus; c, strigil; d, pala; e, posterior femur, ventral surface; f, posterior femur, dorsal surface; g, right paramere.

to anastomose, posterior margin black; clavus black with transverse yellow markings, anteriorly dilated internally and entire, discally and posteriorly fragmented and vermiculate; corium black, with yellow transverse fragmented vermiculate lines, which leave an indefinite black longitudinal line separated from the black internal angle by a single row of yellow marks; membrane-suture slightly paler than the ground-colour, right membrane black with yellow vermiculate fragmented markings, left membrane hyaline internodapically; yellow below, legs yellowish, apex of intermediate tarsi light brown.

Pronotum rastrate; about once and three-fifths as wide as long; with a longitudinal carina throughout, strongest

in the anterior third; lateral angles obtuse; rounded posteriorly.

Lateral lobe of prothorax parallel-sided, rounded posteriorly.

Xyphus subequilateral, rounded apically.

Clavus slightly rastrate, corium not rastrate.

Intermediate leg with the tibia about half as long again as the tarsus, claws nearly as long as the former.

Posterior femur dorsally with a sinuate oblique sub-basal hair-row and two small spines near the posterior margin distally; ventrally with the proximal pubescent area reaching in the mid-line beyond the centre of the latter, non-pubescent distal area with a double row of spines which does not reach the apex; anterior border with three strong spines; posterior margin with three spines and a group of long hairs sub-apically*.

♂. Facial impression shallow, extending up between the eyes almost to the vertex, semicircular above.

Anterior trochanter without a hair-pencil. Pala narrowly cultrate with a single unbroken row of twenty-six pegs.

Strigil irregularly ovoid with six tooth-rows.

Right clasper very broad with a dilatation on its inner side, an irregular and finely spinous crest on its outer sub-apically, and a row of denticles just inside the tooth-like apex.

♀ slightly larger than ♂.

Length, ♂ 5.4 mm., ♀ 6 mm.

♂, ♀ (*type* and *allotype*), Kampala, Uganda, 30.i. 1927 (*H. Hargreaves*).

The smooth corium and almost smooth clavus would have led earlier workers to ally this species to *selecta*. The extraordinary hypertrophy of the right paramere shows, however, that *chinana* has no affinity with any of the groups of *Arctocoris* (*Callicoris*, Jacz.), which Jaczewski has described among the European members of the genus. This hypertrophy is, however, characteristic of all the Ethiopian species that I have examined.

I have much pleasure in associating this species with the name of Mr. W. E. China, to whom I owe invaluable assistance with the literature of the group.

* I am indebted to Mr. O. W. Richards for calling my attention to the valuable characters afforded by the ventral surface of the posterior femur.

XXXVII.—*Exotic* Muscaridæ (*Diptera*).—XXII. By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

Family Muscidæ.

Subfamily PHAONINÆ.

Genus AURIA, nov.

This genus has much the same appearance as typical species of *Dichæatomyia*, Malloch, but the prosternal plate is bare, and the third wing-vein is bare. The fourth vein is bent forward slightly before apex, the pteropleura is haired in part, and the anterior postsutural dorsocentrals are much shorter than the posterior pairs. In most other characters the genus agrees very closely with *Dichæatomyia*.

Genotype, the following species.

Auria elegans, sp. n.

Male and *Female*.—Shining testaceous-yellow, almost without dusting except on the face and frons. Interfrontalia brownish, with a central line and the ocellar region fuscous, palpi deep black, their apices broadly white; antennæ yellow. Abdomen sometimes brownish on dorsum. Bases of femora usually slightly browned, tibiæ except the bases, and all of tarsi, brownish fuscous. Wings hyaline, veins, calyptæ, and halteres yellow.

Eyes almost bare; frons in male linear, in female about one-fifth of the head-width; arista plumose; parafacials invisible in profile; vibrissal angle with numerous short stiff dark setulæ above the long bristle which ascend the facial ridges to the point where the parafacial is obliterated; palpi broad and leaf-like. Thorax with 2+4 dorsocentrals, the two posterior pairs longest; intra-alars both present, but the anterior one short; prealar short; sternopleurals 1+2; scutellum bare on sides and below; postalar declivity bare. Abdomen short-ovate, without well-developed bristles. Fore tibia without a posterior median bristle; mid-tibia with two or three posterior bristles; hind femur with a few short fine bristles on apical third of antero-ventral surface; hind tibia with one antero-dorsal and two or three antero-ventral bristles. Wings rather pointed; outer cross-vein much curved, at about its own length from inner.

Length 6.5–7.5 mm.

Type, allotype, and 7 paratypes, Mt. Maquiling, Luzon, Philippine Islands (C. F. Baker).

Type in U.S. National Museum, paratypes in British Museum and collection of author.

This genus and all of the new genera described in this paper are included in a synoptic paper dealing with the genera of Muscidæ of the world which I hope to put into the hands of the printer within a few months.

Genus CHÆTAGENIA, nov.

This genus is readily distinguished by the presence of hairs on upper apical portion of hind coxæ above bases of femora, hairs on lower basal portion of stem-vein of wing, and on third and fifth veins. In addition to the characters cited, the frons of female has two short strong outwardly and backwardly directed bristles on upper part of each orbit, and two inwardly directed bristles in front of them, one near the middle, the other at anterior extremity, with a few finer bristles between them; the facial ridges are fine-haired on almost their entire length, the cheek has a long strong bristle near middle which is upwardly curved, the vibrissa is very long, the metapleural callus has some fine hairs, there are also black hairs along the lower margin of metathoracic spiracle, the scutellum is haired on sides, and the fourth vein is bent forward slightly but distinctly at apex. The surface-hairs on the wings are much longer than usual.

Genotype, the following species.

Chætagenia stigmatica, sp. n.

Female.—Shining fulvous-yellow, antennæ and face paler, upper half of frons glossy black, upper half of occiput fuscous and with grey dust; dorsum of thorax with two broad ill-defined brownish vittæ; scutellum dark brown; abdomen glossy brownish black, the sternites and base of venter yellowish. Legs entirely yellow. Wings greyish hyaline, both cross-veins and costa slightly clouded, and a brown cloud on costa between apices of auxiliary and first veins. Calyptræ greyish, margins brown. Halteres yellow.

Eyes bare; frons at vertex about one-fourth of the head-width, and not over half as wide as long, orbits narrow, with setulæ laterad of the bristles; ocellars long and widely divergent; inner verticals longer than outer pair; post-verticals short; parafacial linear in profile; cheek not as high as width of third antennal segment; the raised portion sparsely bristled, and with one long strong upcurved bristle

at anterior margin ; third antennal segment broad, extending almost to mouth-margin, and about four times as long as second segment ; arista long, and sparsely plumose above, shorter-haired below ; palpi slender. Thorax with 2 + 3 pairs of dorso-central bristles, anterior presutural pair very short ; prealar short ; anterior intra-alar lacking ; prescutellar acrostichals short ; sternopleurals 1 + 2. Abdomen with many hairs, but no strong bristles. Fore tibia with a short posterior median bristle ; mid-tibia with 7-9 short posterior bristles ; hind femur with some short antero-ventral bristles, one near apex longer ; hind tibia with one antero-ventral and two antero-dorsal bristles. Inner cross-vein about two-fifths from apex of discal cell and below apex of first vein.

Length 5 mm.

Type, San Vincente, 29. x. 1893 (*J. Metz*). I am informed that this is a Brazilian species (Hamburg State Museum).

Genus **LASIOPELTA**, nov.

This genus resembles *Dichatomyia*, Malloch, in some respects, but the pteropleura is bare, the third wing-vein is setulose at base both above and below for a considerable distance, the fourth vein is but slightly bent forward at apex, and there are no hairs below the base of lower calypter. The prosternum is haired, the prealar bristle is quite long, and both pairs of intra-alar bristles are present.

Genotype, *Lasiopelta orientalis*, sp. n.

There are two species before me, which may be differentiated as below :—

- A. Frons of male at narrowest point wider than third antennal segment; thoracic dorsum when seen from behind with three very distinct dark vittæ between the dorsocentrals on presutural area; legs entirely honey-yellow; hind femur with a series of long hair-like bristles on basal half or more of postero-ventral surface, which become shorter apically *orientalis*, sp. n.
- AA. Frons of male at narrowest point not as wide as third antennal segment; dorsum of thorax when seen from behind with only two dark presutural intradorso-central vittæ, the central one faint or absent; legs honey-yellow, tarsi fuscous; hind femur with two or three widely separated bristles on basal half of postero-ventral surface *similis*, sp. n.

Lasiopelta orientalis, sp. n.

Male.—Shining brownish yellow, with pale grey dusting. Upper occiput and frons fuscous, the latter reddish in front;

antennæ, palpi, and aristæ basally honey-yellow; face and frons white-dusted. Thoracic dorsum slightly infuscated, rather distinctly vittate when seen from behind, three dark vittæ between the presutural dorsocentrals; a dark spot below base of wing. Abdomen brownish fuscous, paler at base, with slight greyish dusting, most distinct on fourth visible tergite, and no markings. Legs honey yellow. Wings yellowish hyaline, veins pale, a quite noticeable brown cloud on inner cross-vein and a much fainter one on outer cross-vein, noticeable only at its extremities. Calyptreæ and halteres brownish yellow.

Eyes with some sparse microscopic hairs; frons wider than third antennal segment, each orbit with about six strong bristles, the anterior one longest, ocellars short but strong, parafacial almost linear; facial ridges haired to above middle; antennæ extending to near mouth-margin, third segment about four times as long as second, and as wide as height of cheek; arista plumose; palpi slender. Thorax with 2+4 dorsocentrals, two strong intra-alars, one pair of prescutellar acrostichals, and three sternopleurals; the scutellum haired on sides. Abdomen short and stout, fourth visible tergite with discal and apical series of bristles; basal sternite haired. Fore tibia without a median posterior bristle; mid-tibia with about three posterior bristles; hind femur with a complete series of bristles, weaker basally, and a series of postero-ventral bristles on basal half or more; hind tibia with one antero-dorsal and 4-5 antero-ventral bristles, the postero-dorsal surface with a strong median setula. Second wing-vein curving forward beyond apex of first and running rather closer to costa than usual from there to apex; inner cross-vein at two-fifths from apex of discal cell.

Length 7 mm.

Type, Bukit Kutu, Selangor, Federated Malay States, 3500 feet, April 18, 1926 (*H. M. Pendlebury*).

The type-specimens of this and all other new species collected by Mr. Pendlebury are to be deposited in the British Museum.

Lasiopelta similis, sp. n.

Male.—Similar to *orientalis* except as stated in synopsis, and in having the inner cross-vein of wing less noticeably clouded, the outer cross-vein faintly and uniformly clouded, the fronto-orbital bristles more numerous and much weaker and shorter, the cheeks black, and the second wing-vein even more noticeably approximated to costa.

Length 7 mm.

Type, Bukit Kutu, Selangor, Federated Malay States, 3500 feet, April 13, 1926 (*H. M. Pendlebury*).

Genus PAHANGIA, nov.

This genus has the prosternum haired, the pteropleura bare, the third wing-vein setulose above and below at base, first wing bare, fourth vein slightly curved forward near apex, anterior intra-alar and prescutellar acrostichal bristles lacking, the prealar very small, sides of scutellum bare, and second wing-vein gradually approaching costa, not bent forward as in *Lasiopelta*.

Genotype, the following species.

Pahangia flavipennis, sp. n.

Male.—Black; head whitish-dusted, thorax and abdomen distinctly shining, and with brownish dust, the thoracic dorsum when seen from behind with four black vittæ, two narrow submedians between the dorsocentrals in front of suture and two broad laterals, between which along the line of dorsocentrals anteriorly the dust is whitish, dusting on abdomen checkered, but no distinct dorsal markings present. Antennæ and palpi black. Legs honey-yellow, coxæ and tarsi black. Wings yellow hyaline, veins bright orange-yellow basally. Calyptræ and halteres orange-yellow.

Eyes almost bare; frons about as wide as third antennal segment, orbits with strong bristles on anterior half, longest anteriorly, and a pair of backwardly directed bristles just in front of anterior ocellus; ocellars of moderate length; parafacials almost invisible from the side; antennæ extending about four-fifths of the way to mouth-margin, third segment about 2.5 as long as second; arista long plumose; cheek as high as width of third antennal segment; palpi slender. Thorax with 2+4 dorsocentrals; scutellum slightly elongated, with four long and four very short bristles; sternopleurals 1+2; hypopleura bare. Abdomen elongate-ovate, bristles on sides and apex of third visible tergite and on disc and apex of fourth long and strong. Fore tibia without a median posterior bristle; mid-tibia with 2-3 posterior bristles; hind femur with a series antero-ventral bristles, longest apically; hind tibia with one antero-ventral and one antero-dorsal bristle. Inner cross-vein a little over one-third from apex of discal cell, apical section of fourth vein about 2.5 as long as preapical.

Length 7-8 mm.

Type, Gunong Benom, Pahang, Federated Malay States, 5000 feet, July 27, 1925 (*H. M. Pendlebury*). Two male paratypes, Cameron's Highlands, Pahang, F.M.S., 5100 feet, March 14, 1925, on *Rhododendron* (*H. M. Pendlebury*).

Genus PENDLEBURYIA, nov.

This genus has the eyes in both sexes separated by about one-third of the head-width, the upper bristle on each orbit curved outward over eye, and the others incurved, the post-verticals shorter than the ocellars, all verticals strong, third antennal segment much wider than parafacial and about four times as long as second, arista plumose, palpi normal, prosternum, centre of propleura, pteropleura, and hypopleura bare, first posterior cell not noticeably narrowed at apex, and the third wing-vein setulose above and below to, or almost to, inner cross-vein.

Genotype, *Mydæa longicornis*, Stein.

Pendleburyia longicornis (Stein).

I have before me four specimens from the Federated Malay States which show much variation in colour of wing, some having the apices dark and others the wings hyaline.

Genus DICHÆTOMYIA, Malloch.

Dichætomyia malayana, sp. n.

Male.—Head fuscous, face and central portion of parafacials testaceous, frontal orbits and face white-dusted; antennæ pale yellow; palpi orange-yellow. Thorax fulvous-testaceous, dorsum more brownish except on lateral margins with three white-dusted vittæ on mesonotum dividing the dark portion into four brown vittæ, the submedian pair narrow, the sublaterals broad, and black on outer edges, the lateral white-dusted vittæ extending on to scutellum but not to its apex; pleura with a dark mark below base of wing, the hairs all black. Abdomen fulvous-testaceous, blackened from near base of second visible tergite, and on entire disc of succeeding tergites, the fourth with white dust. Legs fulvous-yellow. Wings yellowish hyaline, veins pale brown. Calyptræ and halteres orange-yellow.

Frons about twice as wide as third antennal segment, orbits narrow, bristled on their entire length; arista plumose; parafacials linear; cheek not higher than width of third antennal segment. Thorax with 2+4 dorsocentrals; pleural

knob bare; no hairs below lower calypter, the prealar minute or absent, the hairs continued over sides of scutellum and invading ventral surface. Abdomen narrowly ovate; fifth sternite with a deep U-shaped central excision and a bare, slender, chitinous, slightly curved process extending backward from the outer posterior angle on each side at level of apex of the incision. Fore femur without antero-ventral bristles; fore tibia without a median posterior bristle; mid-legs lacking in both specimens; hind femur with some rather short preapical antero-ventral bristles and one or two similar bristles on central portion of postero-ventral surface; hind tibia with one short antero-ventral and two longer antero-dorsal bristles, the postero-dorsal surface with some setulæ. Stem-vein with some hairs in hollow in under side of basal section, third vein bare at base above.

Length 7-8 mm.

Type, Pahang, Lubok Tamang, F.M.S., 3500 feet, June 10, 1923; paratype, Pahang, Kuala Tahan, F.M.S., 300 feet, Nov. 23, 1921 (*H. M. Pendlebury*).

Belongs to the *quadrata* group; distinguished by the peculiar fifth sternite.

Genus *PÆCILOPHAONIA*, Malloch.

In a recent paper in 'Konowia' (1927) Dr. G. Enderlein has erected a new genus (*Lasiomala*) for *Aricia flavithorax*, Stein, and two other species. As I erected *Pæcilophaonia* in 1922 for the reception of *flavithorax* this action of Enderlein's is not necessary and his genus is a synonym of mine.

Genus *DARWINOMYIA*, Malloch.

This genus was erected in Part V. of this series of papers (1922) for a species described as new under the name *univittata*. In 1927, in the paper already referred to above, Dr. Enderlein erected the genus *Acrolasia* for the same concept, naming as genotype *Limnophora univittata*, B got.

An examination of material now available to me indicates that there are four species that belong to the genus, which are distinguishable as below.

Key to the Species.

1. All tibiæ and tarsi, and the palpi and antennæ,
black or fuscous 2.
- Tibiæ, except sometimes the bases of hind pair,
and entire palpi, yellow 3.
2. Lower half of pleura deep black, upper half
fulvous-testaceous, vitta on mesonotum covering

- all of the region between the series of dorso-central bristles; head entirely black. *nigriventris*, sp. n.
- Pleura fulvous-testaceous, with a black vitta along middle traversing lower portion of mesopleura and pteropleura, vitta on mesonotum narrower, not filling entire area between the series of dorso-central bristles; cheeks and lower half of occiput testaceous-yellow *univittata*, Bigot.
3. Hind femora and tibiæ in male entirely testaceous-yellow *chilensis*, Bigot.
- Hind femora on apical halves, and hind tibiæ at s, blackened *confusa*, sp. n.

N.B.—I did not mention in my description of the genus the long, strong, downwardly directed, composite spine on the anterior side at apex of fore coxa on male. This is present in the males of all three species in which this sex is known and may be a generic character, though confined to one sex.

Darwinomyia nigriventris, sp. n.

Female.—Head including antennæ and palpi, lower half of thorax, the metanotum, abdomen, and legs including coxæ, black. Wings greyish hyaline. Calyptreæ yellow. Halteres yellow, their knobs brown.

Structurally similar to *confusa*, but slightly smaller, and the acrostichals on the thorax weaker.

Length 6-6.5 mm.

Type and one paratype, Chile, 1924 (*A. Faz*).

Darwinomyia univittata, Bigot.

A larger species than the foregoing, with characters as in *confusa*, but readily distinguished as indicated in the foregoing key to the species.

Two males, Chile (*A. Faz*).

Darwinomyia confusa, n. n.

This is a new name for *univittata*, Malloch, nec Bigot. Apparently a more southern species than *chilensis*. I have no new material of the species available.

Darwinomyia chilensis, Bigot.

The female which I have recorded as *univittata*, Malloch, from Chile, is possibly this species. I have before me a number of specimens of both sexes from Chile.

Genus *PECTINISETA*, Stein.

This genus is similar to *Lispocephala*, Pokorný, in most respects, but it is readily distinguished in the male sex by the presence of long hairs on only the upper side of the arista. The female has long hairs on both upper and under sides of arista.

Pectiniseta prominens, Stein.

This is the only known species of the genus. It was originally described from the island of Sokotra, and has also been recorded from Ceylon and German East Africa by Stein in 1910.

I have seen specimens from Formosa (*H. Sauter*), and Selangor, Bukit Kutu, Federated Malay States, 3500 feet, April 12, 1926 (*H. M. Pendlebury*).

It is expected that at least one specimen will be deposited in the British Museum.

Genus *PHAONIA*, Robineau-Desvoidy.*Phaonia whiteheadi*, sp. n.

Male and Female.—Shining black, with whitish dusting. Face, orbits, and cheeks quite densely white-dusted, interfrontalia of female black; antennæ and palpi black. Thorax with two white-dusted vittæ along the lines of dorsocentrals which are quite conspicuous when the thorax is viewed from behind. Abdomen of female without distinct dusting, that of male with a large triangular patch of whitish dust on each anterior lateral portion of tergites 2 to 4 inclusive. Legs fuscous, tibiæ brownish yellow. Wings greyish hyaline, veins yellowish at bases. Calyptræ orange-yellow. Halteres yellow, their knobs black.

Eyes with quite evident hairs; frons of male not as wide as third antennal segment, that of female about one-fourth of the head-width at vertex, wider anteriorly; orbits bristled in front in both sexes, bare in male above, and with two backwardly directed bristles on each orbit above in female; arista plumose; cheek a little higher than width of third antennal segment. Thorax with 2+3 long strong dorso-centrals, the presutural acrostichal hairs short and fine, in two series, the prealar bristle long, sternopleura with 1+2 bristles, and the hypopleura bare. Abdomen narrowly ovate, quite strongly bristled apically, both at apices and on disc of third and fourth visible tergites. Fore tibia with a strong median posterior bristle; mid-tibia with two posterior

bristles; hind femur with a series of antero-ventral bristles, only a few at apex strong; hind tibia with calcar long, and one long antero-dorsal and two short antero-ventral bristles. Inner cross-vein about one-third from apex of discal cell; fourth vein not noticeably curved forward at apex; third vein not setulose at base.

Length 6 mm.

Type, male, allotype, and one female paratype, Negros, P.I., 6000 feet (*Whitehead*).

Named in honour of the collector.

Differs from the two species of the genus known to me to occur in this general region by the shining black colour and the presence of a median posterior bristle on the fore tibia, besides several other characters.

Subfamily *STOMOXYDINÆ*.

In most collections of Muscidae sent to me for identification there are species of this subfamily, and I have found it practically impossible to determine most of them from descriptions. In fact, the differentiation, and even the validity, of the various genera is a matter of considerable doubt, if one depends upon printed descriptions alone. I have consequently been compelled to formulate a key for the identification of the genera which is based upon an examination of the genotypes, and have included this in my key to the genera of Muscidae of the world, which I have delayed sending to the press pending an opportunity to examine two large collections of material recently received. I therefore include in the present paper a synopsis of the genera of Stomoxydinæ in the hope that it may prove of interest and use to students of those blood-sucking flies, and I also append some notes on the various genera available to me now.

The subfamily is readily distinguished from any other in Muscidae by the structure of the proboscis, which is heavily chitinized and rigid, swollen at base, gradually tapered from basal swelling to apex, and without fleshy apical labellæ. The palpi may be much shorter than the proboscis or almost as long as it, and the arista may be furnished with long hairs only on the upper side, or have additional shorter hairs below. The fourth wing-vein is always curved forward at apex, but never angularly bent, and the lower calypter is much larger than the upper, narrowly rounded at apex, and well separated from scutellum at base on inner side. All genera have the pteropleura and prosternum haired in part.

Some of the species are almost world-wide in their distribution, while others are confined to certain parts of the tropics of the Old World.

Key to the Genera.

- | | | |
|--|----|------------------------|
| 1. Palpi very much shorter than proboscis;
centre of propleura haired; some very
fine hairs on posterior upper side of
stem-vein near level of humeral cross-
vein; anterior sterno-pleural bristle
lacking | 2. | |
| Palpi extending almost or quite to apex
of proboscis | 3. | |
| 2. Arista without long hairs below | 4. | |
| Arista with some long hairs below; an-
terior sterno-pleural bristle present ... | | |
| 3. Propleura bare in centre; proboscis slen-
der, longer than head; first vein bare
above; anterior sternopleura present .. | | [& Serville. |
| Propleura haired in centre; proboscis stout,
not longer than head; first vein with
some hairs basally above; anterior sterno-
pleural bristle minute or indistinguish-
able | | HÆMATOBIA, St. Fargeau |
| 4. Propleura and hypopleura bare in centre . | | STYGEROMYIA, Austen. |
| Propleura and hypopleura haired in
centre | | BDELOLARYNX, Austen. |
| | | HÆMATOBOSCA, Bezzi. |

Genus *STOMOXYS*, Geoffroy.

There are twenty-five species listed as valid in Stein's list of Anthomyiidae of the world, but how many really valid species there are it is impossible to determine without an examination of the type-specimens of the described species. It is not at all improbable that more than half of these will turn out to be synonyms, as no characters other than colour have been cited in most of the descriptions and it is possible to find considerable variation in this respect in the same species.

It is strange that in *Musca* the only species so far authentically recorded as occurring in the New World is *domestica*, Linné, and in *Stomoxys* only *calcitrans*, Linné, is known to occur there. I have seen this last-named species from every region from which I have received material in this family.

How many species of this genus occur in Africa and the Orient I do not know, but I have a number of closely related forms now in my possession.

Genus *HÆMATOBIA*, St. Fargeau & Serville.

This genus is almost cosmopolitan in its distribution. There are two species recorded from North America, but whether they are distinct I am unable to say as I have not seen any specimens except those that belong to *irritans*, Linné. I think it highly probable that *alcis*, Snow, is the same species.

Genus *BDELLOLARYNX*, Austen.

This genus has as its genotype *sanguinolentus*, Austen, and a comparison of this species and *Stomoxys stimulans*, Meigen, proves that there are no characters of generic value for their separation. In one recent generic key they are distinguished from each other by the absence of setulæ on base of third vein in *Bdellolarynx*, and their presence in *Lyperosiops*, Townsend, of which genus *stimulans* is the genotype. The distinction does not exist, as setulæ are present in both species*.

Bdellolarynx has priority over *Lyperosiops*, the latter having been proposed to supplant *Lyperosia* of authors, not *Lyperosia*, Rondani, the latter being a synonym of *Hæmatobia* and isogenotypic with it.

The genus has not heretofore been recorded from the New World, but I have one species from Surinam which is evidently undescribed.

Bdellolarynx flavicornis, sp. n.

Male.—Similar to *stimulans*, Meigen, in general colour, but the antennæ are testaceous-yellow, similar to the palpi. The thorax and abdomen in the type-specimen are greasy, so that it is not possible to describe the markings accurately, but they appear to be similar to those of *stimulans*.

The eyes are comparatively larger than in that species and the frons is not as wide as third antennal segment, with fine hairs on entire length of the narrow grey-dusted orbits; the face is vertical, more like that of *sanguinolentus*, Austen, than that of *stimulans*, and the vibrissal angle is not noticeably produced; parafacials obsolete below when head is seen from the side; palpi slender, as long as proboscis, with three or four rather long widely spaced bristles below

* In the genotype (*Bdellolarynx sanguinolentus*, Austen) setulæ on the third vein are scarcely perceptible, but, if present, are only one or two in number, very minute and confined to the extreme base.—E. E. AUSTEN, 23. iv. 1928.

and many shorter bristles above. Thoracic dorsum not so densely haired as in *stimulans*, the hairs shorter and stronger. Mid-femur with a rather strong bristle near base on ventral surface, the hind femur with a fine hair at same place and one strong preapical antero-ventral bristle; hind tibia with a short median antero-dorsal bristle. Otherwise as *stimulans*.

Length 6·5 mm.

Type, Upper Para, Surinam (*J. Michaelis*). In Hamburg Museum.

Genus *STYGEROMYIA*, Austen.

I have before me a specimen which I consider is referable to the genotype, *maculosa*, Austen, and have drawn my generic characters therefrom.

Stygeromyia maculosa, Austen.

Besides the characters mentioned in the generic key the following appear to be worth mention as possibly of specific, or even generic, value. The palpi are club-shaped, with strong bristles above and at apices, and fine hairs below, the hind tibia has no median bristles, and the third wing-vein is setulose at base.

One female, Zomba, Nyasaland (*Dr. H. S. Stannus*)*.

Genus *HÆMATOBOSCA*, Bezzi.

I have seen only the genotype of this, *atrpalpis*, Bezzi.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 17th, 1928.—Dr. F. A. Bather, M.A., F.R.S.,
President, in the Chair.

The PRESIDENT prefaced his Anniversary Address by briefly recalling the chief services rendered to geological science by some of those recently deceased: among Foreign Members, G. von Tschermak (elected 1886), E. Kayser (el. 1899), P. H. von Groth (el. 1900),

* This specimen should perhaps be referred to *Stygeromyia sanguinaria*, Austen, rather than to *S. maculosa*, Austen. Specimens of the former from Nyasaland, including the ♀ type, are already in the British Museum. *Stygeromyia maculosa*, on the other hand, occurs in S.W. Arabia (Little Aden) and in Somaliland; its existence in India (Punjab and Madras) has also been recorded respectively by Mitter and Paton. —E. E. AUSTEN, 28, iv. 1928.

E. Haug (el. 1921), and C. Diener (el. 1926); among Foreign Correspondents, the Hon. F. Springer (el. 1904); among the Fellows, Alan Lambert (el. 1862), Prof. A. Liversidge (el. 1873), W. H. Shrubsole (el. 1878), the Rev. H. N. Hutchinson (el. 1881), Sir William Galloway (el. 1899), and J. B. Hill (el. 1910).

Comparing the palæontology of to-day with that of forty years ago, the PRESIDENT laid stress on the change from the static period of descriptive morphology to the dynamic period of physiology and ethology. The two divisions of palæontology in its modern aspect are Biostratigraphy and Palæobiology. Glancing at the former, he turned to the latter and selected for consideration the section of it termed Palethology, which deals with the habits of extinct creatures and the response of both habit and structure to their surroundings. This he illustrated by a few of the many ways in which the fossil stalked Echinoderms reacted to their environment, dealing mainly with the structure of the stereons, the various types of stem, the relations to gravity, the effect of habitat, the modes of feeding, and the sanitary arrangements.

The problem of adaptation was then considered, it being maintained that this underlaid all the main conclusions of Palæontology, such as Dollo's Law of Irreversibility, the Biogenetic Law of Haeckel, Rosa's Law of Progressive Reduction of Variability, and Orthogenetic Trends. The Lamarckian and the Darwinian explanations were contrasted, and it was shown that, in ultimate analysis, the former must depend on the latter. The modification of Darwin's theory, expounded by Cuénot, was held to be in the main just another way of looking at the same facts. Even if the two supposed processes differ, both may operate on the same population at the same time. Both explanations of adaptation postulate a succession of mutations, and the main question to-day is: Why do mutants so often assume the same character as the adaptive modification? Summing up a discussion of recent theories of mutation, the speaker concluded that if a complex physico-chemical structure were admitted as a basis of variation, and if the irreversibility of the chemical changes in it were allowed, then it seemed to provide that fundamental premiss from which, in combination with a varying environment, all the Laws of Palæontology could be deduced.

The continuous process of adaptation to a constantly changing environment leads to death—death of the individual and death of the race. Families, Orders, and Classes, after reaching the acme of specialized adaptation, have, on that very account, perished and have been succeeded in the procession of life by hitherto humble followers. Man himself has sprung from the ranks, and he, too, is subject to the same laws. Man will perish as a race, and we know not what will succeed him. *Omnes eodem cogimur.*

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 10. OCTOBER 1928.

XXXVIII.—*Erotic* Muscaridæ (*Diptera*).—XXIII. By
J. R. MALLOCH, Bureau of Biological Survey, Washington,
D.C.

Family Calliphoridae.

Subfamily *SARCOPHAGINÆ*.

I have studiously refrained heretofore from publishing anything on this subfamily in this series of papers, but have, nevertheless, for several years been trying to get together data upon the generic concepts with a view to deciding how many valid genera there are. The task has been an interesting one, but unfortunately I have not been able to complete my work. In the present paper I present descriptions of a few striking African species which have been in my hands for two or three years. I place these in the genus *Sarcophaga*, and though it is possible they may be referable to several subgenera I can see no good reason why any of them should be assigned to a distinct genus.

In this magazine recently (xix. p. 527, 1927), Mr. C. H. Curran referred five African species to the genus *Angiometopia* (sic). Some of these species had previously been referred to the genus (*Angiometopa*), but I doubt both the accuracy of the reference and the validity of the genus. Originally the genus was distinguished from *Sarcophaga* by the presence

of fixed black spots on the dorsum of the abdomen (as against the changeable checkering on the abdomen of *Sarcophaga*), and Stein in his paper on the European Tachinidæ considered it as a synonym of *Agria*. I have examined the genotype of *Angiometopa (ruralis, Fallén)*, and can find no structural character which would justify its generic separation from *Sarcophaga*. I discuss the characters of the species in a subsequent page herein.

All five species included in the present paper have both cross-veins of the wing conspicuously marked with black clouds, and in all cases all, or a portion, of the apical section of fourth vein beyond the angle distinctly clouded also. All have the legs black, which distinguishes them from *dimidiatipes*, Villeneuve, included in *Angiometopia* by Curran; the lack of wing-spots distinguishes *munroi*, Curran, as does also the presence of but one black spot on the wing in *monospila*, Bezzi. Not one of the included species would be described as having the wing with four black spots as in *octomaculata*, Jaenn. I present below a key to the five species now described.

It appears absolutely certain that *munroi*, Curran, is a synonym of *elegantipes*, Villeneuve, described in 1921.

Key to the Species.

1. Bases of wings, including both the basal scales of costa and the calyptreæ, orange-yellow; thorax with only two pairs of prescutellar dorso-centrals; second visible abdominal tergite without median apical bristles; propleura haired in centre; abdomen slightly bluish-grey dusted and with a dark dorso-central vitta *flavibasis*, sp. n.
2. Bases of wings not orange-yellow, and the basal scale of costa dark 2.
2. Thorax with but one pair of prescutellar dorso-central bristles; abdomen glossy black, without dusting or markings; propleura sparsely haired in centre; second visible abdominal tergite without median apical bristles; mid and hind femora and tibiæ with long black hairs on ventral surfaces, longest on hind legs *nitidiventris*, sp. n.
3. Thorax with at least two pairs of prescutellar dorso-central bristles 3.
3. Thorax with only the posterior pair or presutural and the two posterior pairs of postsutural dorso-central bristles distinct, the latter strong, the anterior presutural pair not and the anterior two or three pairs of postsuturals hardly distinguishable from the discal hairs; mid and hind femora and hind tibiæ of male with long, but not dense, black hairs, those on hind tibiæ

- on all ventral surfaces; abdomen grey-dusted, with a median vitta and a pair of spots on each tergite black; lower calypter with a large brown discal mark *punctipennis*, sp. n.
- Thorax with 2+3 pairs of long strong dorso-centrals; hind tibiæ with a few outstanding hairs on postero-ventral surface in the known male, none on antero-ventral surface 4.
4. Scutellum in female with but four marginal bristles; frons at vertex in same sex over one-fourth of the head-width; prescutellar acrostichals lacking in both sexes *suffusa*, sp. n.
- Scutellum in female with six long bristles on margin; frons at vertex in same sex much less than one-fourth of the head-width; prescutellar acrostichals short but distinct *trinubecula*, sp. n.

Sarcophaga flavibasis, sp. n.

Female.—Head black, with white dusting, changeable in intensity on different parts of parafacials when viewed from the side. Thorax black, rather densely grey-dusted, dorsum with three broad brownish-black vittæ. Abdomen shining black, with slight, even, grey dust, and a dorso-central black vitta, least evident on fourth tergite. Anterior thoracic spiracle brown, posterior one yellow. Legs black. Wings greyish hyaline, quite conspicuously orange-yellow at bases, and with three conspicuous black spots, one over each cross-vein and the third at angle of apical section of fourth vein. Calyptre and halteres orange-yellow. A few of the hairs on lower occiput pale, the others black.

Frons at vertex a little over one-fourth of the head-width, widened to anterior margin, all frontal bristles very strong, each orbit with two forwardly-directed outer bristles, the anterior extremity of each orbital series with about six closely-placed bristles which run diagonally outward and downward, the lowest or about in line with apex of second antennal segment; parafacial at base of antenna about as wide as third antennal segment, narrowed below, with fine hairs above, and about four strong bristles on lower half in a series close to eye; cheek over 1.5 as high as width of third antennal segment, the raised part with some strong bristles in front; third antennal segment broad, about twice as long as second; arista plumose on basal half; palpi club-shaped. Thorax with two pairs of strong prescutellar dorsocentrals, the posterior pair the longer, and in front of these, and also just in front of the suture, a pair of very short bristles, no prescutellar acrostichals evident; prealar quite long, post-humeral bristle in line with the presutural, centre of propleura haired; prosternum bare in front, haired on posterior

portion; centre of postalar declivity setulose; sternopleurals 1:1:1; some hairs below lower calypter, the latter subtruncate at apex. No bristles at apex of first and second tergites centrally, a pair of closely-placed bristles in centre of apical margin of third tergite, a complete series on apex of fourth, and a series of shorter bristles on upper portion of each side of the divided fifth tergite; basal sternite haired; genital segments consisting of a pair of thin yellowish plates, which are opposed, and rounded in outline when seen from above. Legs strongly bristled, normal. First wing-vein bare, third setulose at base below, and about midway to inner cross-vein above.

Length 11 mm.

Type, Nagode, Uganda, 20. xii. 1910 (*C. C. Gowdey*).

Sarcophaga nitidiventris, sp. n.

Male.—Head black, frontal orbits and parafacials brassy, or almost golden, yellow-dusted, the usual changeable patch on upper part of latter, face less densely dusted; antennæ and palpi black. Thorax coloured as in preceding species, but the pleura much less densely dusted, and the covering of posterior spiracle brown. Abdomen shining black, glossy at apex, and without dusting or markings. Legs black. Wings greyish hyaline, not yellow at bases, with three black spots on veins as in preceding species, only the sub-basal scale of costa yellow, and the basal one black. All hairs black. Calyptre whitish. Halteres yellow.

Frons at vertex slightly below level of eyes and about one-sixth of the head-width, widened anteriorly, the interfrontalia about twice as wide as either orbit and of equal width on entire length, inner series of orbital bristles complete and quite strong, no outer forwardly-directed bristles present, the inner series continued along inner margin of orbit to about opposite apex of second antennal segment; parafacials as wide as third antennal segment on their narrowest part, and almost bare except for two to three bristles near lower margin of eye; cheek higher than width of third antennal segment, rather strongly bristled on anterior portion of the raised part; third antennal segment not twice as long as the rather long second segment; arista plumose on basal half; palpi normal. Thorax with but one pair of short dorso-central bristles on hind margin and no acrostichals, the prealar moderately long, and the posthumeral lacking; postalar declivity and centre of propleura haired; prosternal plate haired behind; sternopleurals 1:1:1. Abdomen

subconical, densely long-haired below, apical margins of first and second tergites without, that of third with, a pair of strong central bristles, fourth with an apical series of strong bristles. Mid and hind femora and tibiæ with dense long bristly ventral hairs, longest on hind legs, the hind femora and tibiæ each with a strong preapical antero-ventral bristle. Wing as in preceding species.

Length 14 mm.

Type, Kaweri, Uganda, 3. v. 1911 (C. C. Gowdey).

Sarcophaga punctipennis, sp. n.

Male.—Head black, with white dusting on frontal orbits, face, and parafacials, changeable on the latter; antennæ and palpi black. Thorax black, distinctly shining, with whitish dusting, the dorsum with three black vittæ. Abdomen concolorous with thorax, dorsum quite densely whitish-dusted, each tergite from second to fourth inclusive with a central elongate black mark and on each side of anterior margin a small round black spot; hypopygium glossy black. Legs black, hind tibiæ slightly brownish. Wings greyish hyaline, with the same three black marks as in the preceding two species, and in addition a dark mark at junction of second and third veins. Calyptreæ white, lower one with a large brown discal mark. Halteres brownish yellow. A few of the hairs on lower portion of occiput pale, the others all black.

Frons at vertex almost one-fourth of the head-width, all frontal bristles strong, no forwardly-directed upper orbitals present, the anterior orbitals carried downward as in preceding species, but almost on middle of the orbit; parafacial not as wide as third antennal segment at middle, with a series of fine hairs which at lower extremity become bristle-like; cheek about twice as high as width of third antennal segment, hairs long and setulose; arista plumose on basal half; third antennal segment not twice as long as second; palpi normal. Thorax with 2+4 dorsocentrals, the presutural and anterior two pairs of postsuturals very short, no acrostichals developed; centre of propleura and postalar declivity haired; prosternal plate haired behind; posthumeral and posterior sublateral bristle lacking; sternopleurals 1:1:1. Abdomen bristled on dorsum as in preceding two species, venter not conspicuously haired. Mid-femur at base on postero-ventral surface, and hind femora and tibiæ with rather sparse long bristly hairs, mid-femur with a comb of about ten stout spines at apex on postero-ventral surface; mid-tibia with a short antero-ventral

submedian bristle; hind femur with long sparse antero-ventral bristles; hind tibia with a strong antero-ventral bristle beyond middle. Wings as in preceding species.

Length 8.5 mm.

Type, Kericho, Kenya Colony, iii. 1920 (*F. W. Dry*).

This species differs from the description of *spilogaster*, Wiedemann, in having the hypopygium black; Wiedemann in his description saying "After gelblichroth."

It may be well to state here that *ruralis*, Fallén, the type-species of *Angiometopa*, has the following characters: Frons much as in the above species, but the orbitals do not descend below base of antenna, the parafacials are not strongly bristled below, the arista is rather short-haired, the dorsocentrals are 2+3 and acrostichals 1-2+1, propleura and postalar declivity bare in centre, and the wings have no dark spots. I can detect in the specimens before me no prosternal hairs, the notopleurals are two in number, there is no ventral bristle on mid-tibia in the male, no hairs on hind coxæ above bases of femora, and there is a bristle below the anterior sternopleural. The abdomen is distinctly black-spotted as in the last preceding species.

I have examined also the genotype of *Agria*, Robineau-Desvoidy (*affinis*, Fallén), and find that it agrees in all important characters with *ruralis*. I therefore incline to the opinion held by Stein that these genera are synonymous, and would go even farther than he did and include them in *Sarcophaga*.

The next two included species differ from *punctipennis* in having the propleura bare, but they differ from *ruralis* in having the orbital bristles carried obliquely outward and downward about as far as apex of second antennal segment. Neither of them has the abdomen with distinct black spots on dorsum. Both of the species, as well as the other three herein described, have the hind coxæ haired above bases of femora.

Sarcophaga suffusa, sp. n.

Male and female.—Colour of head and thorax as in the last preceding species, the lateral thoracic vittæ a little wider. Abdomen black, shining, with checkered whitish dusting, most distinct on sides of tergites, and on a spot on each side at anterior margin of each when seen from behind; hypopygium glossy black. Legs black. Wings greyish hyaline, marked as in the other species, but the cloud over apical section of fourth vein less conspicuous and extending

farther along vein. Calyptræ white, lower one with a faint brownish discal mark. All hairs black.

Male.—Frons at vertex about one-fifth of the head-width, the orbits narrow, all bristles long and rather strong, the series extending to apex of second antennal segment on middle of upper part of parafacial, the latter fully as wide as third antennal segment, with rather long hairs, and a series of about four bristles close to margin of eye on lower part; arista plumose on basal half. Thorax with 2 + 3 long dorsocentrals, the acrostichal region with rather long hairs but no discernible bristles; posthumeral bristle slightly mesad of the presutural, posterior sublateral lacking; centre of propleura bare; prosternum haired behind; prealar quite short; apical scutellars moderately long; sternopleurals 1:1:1. Second to fourth tergites each with a series of apical bristles, the space between the middle pair and those on sides of second and third tergites rather wide; all sternites with fine erect hairs. A few long fine hairs on ventral surfaces of hind femora, but none on the mid- and hind tibiæ; mid-tibia with a strong submedian ventral bristle, hind tibia with two strong antero-ventral bristles; hind femur with long sparse antero-ventral and postero-ventral bristles, mid-femur without apical postero-ventral comb.

Female.—Frons about one-third of the head-width at vertex, widened in front, the anterior bristles more diagonally placed than in the male. Only four scutellar bristles present, the apical pair absent. Tergal bristles even stronger than in male.

Length 7–8 mm.

Type, male, allotype, one male and one female paratype, East side of Forest of the Aberdare Mts., 7300 feet, 24. ii. 1911 (*T. J. Anderson*).

Sarcophaga trinubecula, sp. n.

Female.—Differs from the last preceding species in having the thoracic vittæ brown-dusted, the frons at vertex not over one-fourth of the head-width, the scutellum with an additional pair of apical bristles, a short pair of prescutellar acrostichals, and the wing-markings larger and more intense.

Length 9 mm.

Type, Mt. Ruwenzori, Uganda, 14. v. 1911 (*C. C. Gowdey*).

XXXIX.—*A Comparative Study of the Otoliths of the Neopterygian Fishes* (continued). By G. ALLAN FROST.

[Plate XII.]

XVIII. Order PERCOMORPHI (*cont.*).

Suborder TRICHIUROIDEA.

The otoliths of the fishes of the suborder Trichiuroidea are specialized and differ from those of the remainder of the order Percomorphi in the upwardly inclined cauda which opens on the posterior rim of the otolith. In the family Gempylidæ the otoliths are frail and heavily curved, those of the family Trichiuridæ being stouter and flat on the outer side.

In *Thyrsites atun* (Pl. XII. fig. 1) (fam. Gempylidæ) the sagitta is high and curved; the dorsal rim is about one-third the length of the ventral part of the otolith and is highest in its posterior part, the ventral rim is curved and serrated, the posterior rim is extended as a blunt slender process, and the anterior rim consists of an elongated pointed rostrum. The sulcus has a median constriction; the ostium, which extends upon the upper part of the rostrum, is narrow, and deep posteriorly; the cauda is shallow and upwardly inclined, and opens behind the dorsal area above the posterior process.

In *Rexea furcifera* (Pl. XII. fig. 2) (fam. Gempylidæ) the sagitta resembles that of *Thyrsites atun*. It differs in the greater length of the dorsal rim, in the irregular posterior rim which contains three short processes, and in the broad shallow sulcus, the cauda of which is upwardly inclined as in *Thyrsites*.

The otolith of *Trichiurus lepturus* (Pl. XII. fig. 3) (fam. Trichiuridæ) resembles that of *Thyrsites* in the posterior process and in the serrations of the ventral rim. It differs in the ovate shape and regular dorsal rim, in the straighter ventral rim, and in the short rostrum. The triangular undivided sulcus opens widely on the anterior rim; it is divided longitudinally by a ridge, and ends in a slightly upturned point in the middle of the otolith.

In *Lepidopus caudatus* (Pl. XII. fig. 4), of the same family, the sagitta resembles that of *Trichiurus* in shape, in the posterior process, and in the serrations of the ventral rim. It

differs in the form of the sulcus, in which the ostium is slightly oblique and has a rounded end, from the upper part of which a narrow groove-like cauda opens above the posterior process.

Suborder SCOMBROIDEA.

Division SCOMBRIFORMES.

In *Scomber scombrus* (Pl. XII. fig. 5) (fam. Scombridae) the sagitta is small, frail, and curved, but otherwise resembles the Elopine type. The shape is long, and highest in the posterior part; the dorsal rim slopes toward the anterior of the otolith, the ventral rim is straight, the posterior rim is oblique and pointed, and the anterior rim consists of a slender pointed rostrum, a prominent antirostrum, and a large triangular excisura. The sulcus has an angle on the upper margin and opens on the anterior rim; the ostium is small and the cauda straight and downturned at the end, terminating close to the ventral rim. The other otoliths are well developed, the lapillus being stout and conchoidal in shape, and the asteriscus sickle-shaped and frail.

In *Scomber neglectus* (Pl. XII. fig. 6) the sagitta is roughly rectangular in outline, and is more curved than that of *S. scombrus*, which it resembles in the dorsal and posterior rims. It differs in the irregular ventral rim, in the smaller depressed rostrum, in the truncated antirostrum and minute excisura, also in the wide and depressed ostium and in the upward distension of the cauda. The lapillus is conchoidal and is twice the size of that of *S. scombrus*.

In *Scomberomorus regalis* (Pl. XII. fig. 7) (fam. Scombridae) the sagitta resembles generally that of *S. scombrus*. It differs in the greater height of the posterior part of the otolith, in the ventral rim, which is depressed posteriorly, and in the blunt rostrum. It also differs in the wide downwardly-distended ostium and in the fan-shaped and ridged cauda.

The otoliths of *Scomberomorus maculatus* and *S. lineolatum* resemble those of the above species.

The sagitta of *Thynnus thynnus* (Pl. XII. fig. 8) (fam. Scombridae) resembles that of *Scomberomorus*. It differs in the more symmetrical shape, in the absence of an antirostrum and excisura, and in the median constriction of the sulcus, which resembles that occurring in the otoliths of *Labrus mixtus* of the family Labridae; it also differs (in the example

examined) in the distended cauda and in the rounded end of the rostrum.

With regard to the succeeding divisions—*Luvariformes* and *Xiphiiformes* as defined by Mr. Regan*—no material is yet available for the examination of the otoliths.

Suborder SIGANOIDEA.

In the example of *Siganus nebulosus* (fam. Siganidæ) ("Teuthididæ" of Günther) examined, the sagitta was corroded and not suitable for description; the shape is oblong and not so deep as might be expected from such a deep-bodied fish. The asteriscus is larger than is usual in fishes of the order Percomorphii.

Suborder TEUTHIDOIDEA.

In *Acanthurus hepatus* (Pl. XII. fig. 9) (fam. Teuthididæ) ("Acronuridæ" of Günther) the otolith resembles that of *Tilapia*, of the division Perciformes. It differs in the greater convexity, in the large excisura and prominent antirostrum, in the absence of an anterior angle of the sulcus, and in the round downturned end of the cauda, which resembles that of certain Sciaenoid otoliths.

Suborder KURTOIDEA.

In *Kurtus indicus* (Pl. XII. fig. 10) (fam. Kurtidæ) the sagitta is deep and resembles some forms occurring in the family Sparidæ. In the single example examined the sulcus was not discernible.

Suborder ANABANTOIDEA.

In *Ophiocephalus lucius* (Pl. XII. fig. 11) (fam. Ophiocephalidæ) the sagitta resembles that of *Centropomus* of the division Perciformes. It differs in the upturned ostium and in the presence of a small excisura.

In *Anabas scandens* (Pl. XII. fig. 12) (fam. Anabantidæ) the otolith resembles the Serranid type; it differs in the symmetrical shape and in the enclosed ostium, which is intersected by a minute excisura.

* Ann. & Mag. Nat. Hist. ser. 8, vol. iii. p. 72 (1909).

Suborder POLYNEMOIDEA.

The sagitta of *Polynemus lineatus* (Pl. XII. fig. 13) (fam. Polynemidæ) resembles that of *Ophiocephalus*; it differs in the horizontal ostium, in the absence of an angle in the lower margin of the sulcus, in the regular dorsal, and in the pointed posterior rim.

In *Eleutheronema tetradactylus* (Pl. XII. fig. 14), of the same family, the otolith resembles generally that of *Polynemus*; it differs in the blunt rostrum, in the height of the posterior part of the dorsal rim, and in a pointed process of the posterior rim, which forms a continuation of the ventral line; also in the irregular sulcus, in which an angle is present in front of the distended downturned end of the cauda.

SUMMARY.

1. The otoliths of the suborder Trichiuroidea may be distinguished by the upturned cauda, which opens on the posterior rim (except in *Trichiurus*), and by the presence of a posterior process.

2. In the suborder Scombroidea the cauda is downturned or distended, and does not reach the posterior rim.

3. Those of the Tenthidoidea and Kurtoidea are high in shape, as in the Sparid type, while in the suborders Anabantoidæ and Polynemoidea the otoliths resemble those of the Serranidæ and allied species.

EXPLANATION OF PLATE XII.

- Fig. 1. *Thyrsites atun*, $\times 1\frac{1}{2}$.
 Fig. 2. *Rexea furcifera*, $\times 1$.
 Fig. 3. *Trichiurus lepturus*, $\times 3$.
 Fig. 4. *Lepidopus caudatus*, $\times 2\frac{1}{2}$.
 Fig. 5. *Scomber scombrus*, $\times 3$.
 Fig. 6. — *neglectus*, $\times 3$.
 Fig. 7. *Scomberomorus regalis*, $\times 1\frac{1}{2}$.
 Fig. 8. *Thynnus thynnus*, $\times 1\frac{1}{2}$.
 Fig. 9. *Acanthurus hepatus*, $\times 4$.
 Fig. 10. *Kurtus indicus*, $\times 3$.
 Fig. 11. *Ophiocephalus lucius*, $\times 1\frac{1}{2}$.
 Fig. 12. *Anabas scandens*, $\times 2$.
 Fig. 13. *Polynemus lineatus*, $\times 1\frac{1}{2}$.
 Fig. 14. *Eleutheronema tetradactylus*, $\times 1\frac{1}{2}$.

XL.—Description of a new Species of *Platydemia*,
Cast. & Brull. (Coleoptera, Tenebrionidæ). By K. G. BLAIR.

Platydemia nucifera, sp. n.

Oval, convex, moderately nitid, glabrous; upperside black, with on each elytron a round testaceous humeral spot and an elongate apical spot of the same colour; underside reddish piceous, with the antennæ, mouth-parts, and legs testaceous.

Head unarmed in either sex, rather densely and strongly punctate, the eyes separated by a distance about equal to the width of one of them, cheeks distinctly narrower than the head across the eyes. Antennæ stout, third joint scarcely longer than fourth, joints 5 to 10 successively more strongly expanded on inner side. Thorax about twice as wide as in the middle long, widest at base, the sides arcuately narrowed to apex; base and apex both bisinuate and narrowly bordered; disc rather strongly punctate, more sparingly in the middle than towards the sides. Elytra black, with a small reddish humeral spot embracing the sixth to ninth intervals, and an elongate apical streak on the same intervals and attaining the side-margin just before the apex; striæ not very deep, rather strongly punctate, first and second sulcate towards apex, intervals distinctly punctulate. Underside strongly punctate, the median part of first abdominal segment densely, rather finely punctate, and in male clothed with long yellow hair, the sides of the segment very coarsely punctured and rugulose; the second and third segments more sparsely though similarly punctured; last segment strongly convex longitudinally.

Length $3\frac{1}{2}$ mm.

Malaya: Sepang, numerous examples from August 1927 to March 1928 in decayed male flowers of *Cocos nucifera* (G. H. Corbett); Doerian, Riouw Archipelago, June 1923 (Dr. K. Dammerman).

Allied to *P. waterhousei*, Geb. (*plagiatum*, Waterh.), but smaller, the elytra merely with pale shoulder-spots instead of a transverse fascia as in most of the members of this group.

The individual from Doerian is abnormal, having a large deep double fossa on the disc of the thorax, probably due to an accident in the pupal state; otherwise it agrees with the series from Sepang.

XLI.—On a Collection of Humble-Bees (*Hymenoptera*, *Bombidae*) made in Ladakh by Col. R. Meinertzhagen. By O. W. RICHARDS, M.A.

THROUGH the kindness of Dr. J. Waterston of the British Museum, I have been able to examine a small but interesting collection of humble-bees made by Col. R. Meinertzhagen in Ladakh in 1925. The specimens mentioned are all in the collection of the British Museum.

Subgenus SUBTERRANEOBOMBUS, Vogt.

1. *Bombus melanurus*, Lep., subsp. *subdistinctus*, nov.

In India and Tibet occurs a race of *B. melanurus*, Lep., in which the wings of the female are, on the average, much less dark than usual; for this form I propose the name *subdistinctus*, subsp. n. As type I choose a female in the collection of the British Museum labelled "Kashmir, 8-9,000', June 1901, Lt.-Col. C. G. Nurse." The pattern of this specimen is as follows:—Hairs black, thorax above, including a large patch round the anterior spiracle, and tergites 1-2, ochreous-yellow. Wings considerably darkened, but much less so than in Russian specimens of *B. melanurus*, Lep. Particular specimens of *subdistinctus* may have the wings almost hyaline. Other specimens in the collection of the British Museum are:—another female with the same label as the type; one female, Kashmir, Scinde Valley, 7000'; one female, Kashmir, Turring Hore, Krishnye, Wardwan; one female, one worker, Kashmir, Gulmarg, summer, 1913 (*Lt.-Col. F. W. Thomson*); one female, Baltistan; one female, Kunawar, Werong Pass, 13,500', 13th June, 1865; Col. Meinertzhagen obtained one worker at Leh, Ladakh, and one in the Tequr Nubra Valley, 10,400', the latter on 28th July, 1925. These last two specimens have particularly hyaline wings. A male in the collection of the British Museum from Hunza, N. Kashmir, 25th August, 1913 (*R. W. G. Hingston*), is similar, but the whole of the pleura are yellow and the wings are almost hyaline. This sex appears to differ from typical *melanurus* in having the vertex more finely and sparsely punctured.

2. *Bombus difficillimus*, Skor. (1912, p. 609).

In India and Tibet *B. melanurus*, subsp. *tschitscherini*,

Rad., is replaced by a form in which the wings are hyaline (not brown) and the pale hairs are nearly white (not ochreous-yellow). A female of this species was caught by Col. Meinertzhagen at Burzil Chauki, 11,500', 24th August, 1925. The pattern of this specimen is as follows:—Hairs black, a broad thoracic collar, extending a little below the anterior spiracle, scutellum and post-scutellum and tergites 1-2 white, slightly yellow-tinged. Other specimens in the collection of the British Museum are as follows:—five females, Khamba Jong, Sikkim, 15-16,000', 15th-30th July, 1903, Tibet Expedition; one female, Gantok, Sikkim, 24th-26th June, 1903, Tibet Expedition; one worker, Gyantse, 13,000', June 1904 (*H. J. Walton*), Tibet Expedition; one female, Baltistan; one female, Phung Chu Valley, Tibet, 14,000', 11th June, 1922 (*T. G. Longstaff*), 1st Mt. Everest Expedition; two females, Phari, Tibet, 16,000', 19th July, 1924, one worker, Phari, 14,000', 21st July, 1924 (*Major R. W. G. Hingston*), 2nd Mt. Everest Expedition; one female above the Rhumbu Glacier, below 18,500', July 1921, 1st Mt. Everest Expedition.

In the workers the pale hairs tend to be somewhat yellower.

Subgenus *SIBIRICOBOMBUS*, Vogt.

3. *Bombus longiceps*, Smith.

Friese and von Wagner (1909, p. 62) have suggested that this is a variety of *B. hortorum*, L., but the existence of two males in the British Museum collection, as well as the structure of the workers, show that the species belongs to the subgenus in which I have placed it. Skorikov (1922, p. 156) refers *B. longiceps*, Smith, to his genus *Alpigenobombus*, including *B. mastrucatus*, Gerst., etc. Skorikov, however, must be in error (probably owing to the existence of a parallel colour-form in another species), for Smith (1878, p. 8) in his original description states that the head is elongate. The type is probably at Calcutta.

Col. Meinertzhagen obtained two workers at Leh, Ladakh, 4th July, 1925. These are rather small (resembling females of *B. agrorum*, F., in size) and the hairs are black, thorax above and the anterior dorsal half of the pleura ochreous-yellow, tergites 4-5 light red; the hairs of the underside black, except those of sternites 4-6 which are reddish. The wings are hyaline and the hairs rather short and even. A similar worker and two males are in the collection of the

British Museum, from Hunza, N. Kashmir, 18th August, 1913 (*Major R. W. G. Hingston*).

Subgenus *MASTRUCATOBOMBUS*, Krüger
(= *Alpigenobombus*, Skorikov, in part.).

4. *Bombus mastrucatus*, Gerst., subsp. *meinertzhageni*, nov.

This may well be a new species, but the present material is not adequate to decide. The form in question is apparently structurally identical with *B. mastrucatus*, Gerst., but the colour is very different and the hairs are shorter and more even. The hairs are black; a fairly broad thoracic collar extending to below the anterior spiracle, where it becomes somewhat broader, scutellum and postscutellum, and tergites 1-2 bright yellow; tergites 3-5 pale red. Venter dark, fringe of the fifth sternite reddish. Collar slightly narrower than the discal black thoracic band. Wings hyaline. Hairs rather short and even. One female from Shusal.

Subgenus *LAPIDARIOBOMBUS*, Vogt.

5. *Bombus rufofasciatus*, Smith.

Examination of the type of this species and also of the genitalia of a male almost certainly referable here show that *B. rufofasciatus*, Smith, is allied to *B. lapidarius*, L., though the genitalia are by no means identical. Probably further study will show that there are half a dozen allied species inhabiting the Indian hills, but lack of material, especially of males, makes it necessary to describe the colour-forms at present known as varieties of a single species. All these varieties differ from those of another Indian hill-species (probably really allied to *B. pratorum*, L.), otherwise very similar, in having the hairs of the venter of the abdomen mainly dark.

Var. *rufior*, nov.

The hairs are black; a narrow, rather black mixed thoracic collar, extending to the anterior spiracle, scutellum and postscutellum mainly, and tergite 1, white; tergite 2 bright yellow with a few black hairs at its apex; tergites 3-4 bright red; 5 and the long hairs of 6 white. Venter mainly black, with some white hairs at the sides of the apex of the abdomen. Wings hyaline. Hairs of medium length, even. Type, one worker, Burzil Chauki, 11,700', 26th August.

1925 (*Col. Meinertzhagen*) ; also one other worker without precise locality, but captured on the same expedition. Further, one worker in the collection of the British Museum, Shekhar, Tibet, 14,500', 9th July, 1924 (*Major R. W. G. Hingston*), 2nd Mt. Everest Expedition. In the typical form of the species there is no yellow on tergite 2 and tergite 4 is white.

Var. ladakhensis, nov.

The hairs are black ; a rather broad thoracic collar extending almost to the sternum, postscutellum and tergites 1-2, bright yellow ; 3 bright red ; 4 red passing apically into dirty white ; 5 dirty white. Venter dark. Thoracic collar about two-thirds as wide as the black discal thoracic band. One worker (or (?) small female), Shusal, S. Ladakh, June 1925 (*Col. Meinertzhagen*).

Subgenus *BOMBUS*, s. s.

6. *Bombus tunicatus*, Smith.

An examination of Smith's type in the collection of the British Museum shows that this species is closely allied to *B. terrestris*, L. *Col. Meinertzhagen* captured a male at Parkutta, Baltistan, on the 10th August, 1925. The genitalia do not differ from those of *B. terrestris*, L. The pattern is as follows :—the hairs are black, a broad thoracic collar extending halfway down the pleura, scutellum and postscutellum, and tergite 1 are white ; tergite 2 is yellow, with black lateral tufts ; 3 black, 4-7 light red. The black hairs of the sides of the mesonotum are much mixed with white ones. Venter black, of abdomen mainly whitish. Wings considerably infusate. Hairs rather short and even.

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XLII.—New or little-known Tipulidæ (Diptera).—XL. *Australasian Species*. By CHARLES P. ALEXANDER, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.

IN the present instalment various species of Tipuline crane-flies are described, chiefly from New South Wales, Victoria, and Tasmania. As before, the greater number were secured by Dr. Tonnoir on his 1922-23 collecting expedition to Australia. A few additional specimens were secured from the following sources: Bishop Museum, Honolulu, collected by the late R. Helms; National Museum, Victoria, including material secured by the late Mr. F. P. Spry and by Mr. G. F. Hill; University of Queensland, collected by Mr. Hardy; an interesting series from Dr. Ferguson, collected by himself and by Mr. J. Clark in Western Australia; an interesting species of *Dolichopeza* collected by Mjöberg and received in exchange from Mr. Riedel. Except where stated to the contrary, the types of the species in question have been returned to the above institutions. My sincere thanks and gratitude are extended to the many friends and colleagues who have assisted in this study.

Change of Name.—The subspecific name *tasmaniensis* applied to *Elephantomyia tasmaniensis* (Ann. & Mag. Nat. Hist. (10) i. pp. 600-601, May 1928) should be altered to *Elephantomyia tasmaniensis barringtonia*, subsp. n.

Dolichopeza ferox, sp. n.

General coloration brown, the præscutum without distinct stripes; antennæ (♂) short, not attaining the wing-root; legs dark brown, the genua restrictedly whitened; wings with a strong dusky tinge; male hypopygium with the outer dististyle flattened, broad at base, narrowed apically into an acute blackened spine.

Male.—Length about 10 mm.; wing 12.5 mm.

Frontal prolongation of the head brown, the sides broadly yellow; palpi dark brown. Antennæ relatively short, if bent backward not attaining the wing-root; scapal segments obscure yellow, the flagellum dark brown; flagellar segments gradually decreasing in length outwardly, the first nearly equal to the following two taken together. Head dark greyish brown, the vertical tubercle abruptly fulvous-yellow, the front yellowish.

Pronotum and mesonotum dark brown, the præscutum without distinct stripes, the lateral margins a trifle darker. Pleura dark brown, vaguely variegated with paler, especially on the sternopleurite and meron. Halteres dark brown, the extreme base of the stem obscure yellow. Legs with the coxæ brownish yellow, especially the tips, the middle coxæ more uniformly pale; trochanters testaceous, each with the distal half of the inner face blackened; remainder of legs dark brown, only the genua restrictedly whitened. Wings with a strong dusky tinge, paler before and beyond the stigma and just beyond the fork of *M*; stigma large, darker brown; veins dark brown. Venation: *Sc*₁ preserved, perpendicular; cell *M*₁ from one-third to one-half longer than its petiole; second section of *M*₁₊₂₊₃ a little shorter than *M*₁₊₂; *m-cu* about two-thirds its length before the fork of *M*. Conspicuous macrotrichiae on the veins beyond the cord, but virtually lacking on the main veins proximad of the cord.

Abdomen dark brown, indistinctly annulated with obscure brownish yellow, the rings medial in position, somewhat brighter on the sternites; outer segments and the hypopygium more uniformly dark brown. Male hypopygium very different in structure from the other described Australian species. Ninth tergite with the lateral angles produced caudad into conspicuous blackened lobes, the tips of which are obliquely truncated, the broad median area broadly U-shaped, fringed with sparse long setae, the median point with a tiny emargination. Outer dististyle a broad flattened blade that narrows into an acute black spine directed mesad; surface of the style, but especially the mesal edge, densely fringed with long setae; extreme base of style narrowed into a slender petiole. Inner dististyle small, blackened, the tip narrowed, the outer margin with short but conspicuous setae.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, December 1, 1922 (*A. Tonnoir*).

Dolichopeza ferox is the most distinct species of the genus so far discovered in Australia.

Dolichopeza pallidula, sp. n.

1890. *Dolichopeza cinerea*, Skuse, Proc. Linn. Soc. New South Wales, (2) 5, 64; nec *D. cinerea* (Macquart), Dipt. exot., Suppl. i. 9-10, pl. i. fig. 3 (1846).

General coloration pale ochreous-brown; legs yellowish brown; wings pale, the stigma brown, the cord seamed with

pale brown; male hypopygium with the ninth tergite having two acute spinous lobes; outer dististyle elongate, the mesal face with two teeth placed near mid-length of the style.

Male.—Length 8–9 mm.; wing 10–12 mm.

Female.—Length 8.5–10 mm.; wing 10.5–11 mm.

Frontal prolongation of head short, yellowish testaceous to ochreous; palpi darker. Antennæ of moderate length, if bent backward extending to beyond the wing-root; scapal segments paler than the brown flagellum. Head pale, the vertex in cases more infuscated behind, the orbits broadly pale.

General coloration of mesonotum pale ochreous to ochreous-brown, with poorly defined darker markings, the pleura pale yellowish testaceous. Halteres elongate, pale, the knobs dark. Legs with the coxæ yellowish testaceous; trochanters obscure yellow, the mesal face with a brown spot; remainder of legs yellowish brown, the tarsi only a trifle darkened. Wings pale, the stigma dark brown, slightly more yellowish before and beyond the stigma; cord seamed with slightly darker brown; veins brown. Venation: cell *M*₁ relatively short, about one-third longer than its petiole; cell 2nd *A* of moderate width.

Abdomen ochreous, the incisures of the segments narrowly dark brown; hypopygium pale. Male hypopygium with the caudal margin of the tergite produced into two slender spinous lobes, the area between U-shaped, the lobes projecting far beyond the lateral angles of the tergal region. Outer dististyle very long and pale, with two teeth on the mesal face, the broader basal tooth placed about the same distance from the base of the style as the smaller, more acute, outer tooth is placed from the apex, the distance between the teeth including one-fourth the length of the style. Inner dististyle shorter, approximately three-fifths the length of the outer style, the basal half or less with a blackened crest.

Hab. New South Wales.

Holotype, ♂, Botany Bay, September 24, 1904 (*R. Helms*).

Allotype, ♀, Sydney, March 14, 1909.

Paratypes, 2 ♂♂, Wentworth Falls, Blue Mts., November 18, 1921 (*A. Tonnoir*); 1 broken ♂, Sydney, March 14, 1909 (*R. Helms*).

Type preserved in the writer's collection.

This is the fly that Skuse identified as being *D. cinerea* (Macquart), which is a distinct species. According to Skuse *Dolichopeza pallidula* is the commonest species of the genus

in New South Wales, being generally distributed and on the wing from September to February. The flight-period is even longer than this, as can be seen from the records given above.

Dolichopeza victoriæ, sp. n.

General coloration brown, the præscutum with three confluent dark brown stripes; postnotum and pleura pruinose; legs brownish black; wings with a faint dusky tinge, the stigma and seams along the veins darker; abdomen brown, all except the terminal two segments ringed with paler; male hypopygium with the outer dististyle very long, terete; inner dististyle with the apical beak slender.

Male.—Length about 8–8.5 mm.; wing 9.3–9.8 mm.

Frontal prolongation of head yellowish brown with a narrow dusky lateral line; palpi dark brown. Antennæ brownish ochreous, the first scapal segment darker apically, the flagellum black; antennæ of moderate length, if bent backward extending to shortly beyond the wing-root. Head broad, dark grey, the anterior vertex yellow.

Mesonotal præscutum with the disk virtually covered by three confluent dark brown stripes, the lateral margins and small humeral region obscure yellow; scutum obscure yellow, each lobe largely dark brown, the posterior callus dark; scutellum paler brown, the caudal margin darker; postnotum pruinose. Pleura brown, heavily grey pruinose; dorso-pleural membrane bicolorous, the dorsal portion dark brown, the ventral portion yellow. Halteres pale, the knobs dark brown. Legs with the coxæ dark, sparsely pruinose; trochanters brownish yellow, with the usual black spot on mesal face: remainder of legs brownish black, only the femoral bases very narrowly paler. Wings with a faint dusky tinge; stigma darker brown; cells *C* and *Sc* and all the longitudinal veins except *M* and 1st *A* seamed with darker; paler areas before and beyond the stigma and across the cord at *r-m*; veins brownish black; obliterative areas along the anterior cord. Macrotrichiæ on the veins almost to the wing-base. Venation: cell *M*₁ deep, about four to five times its petiole, in some cases the cell shallower, only about two and one-half times its petiole; *m-cu* about one-half times its length before the fork of *M*.

Abdomen brown, the basal segments ringed with pale, including a conspicuous ring before the end of sternite 2, much less evident on the tergite; segments 3 and 4 at mid-length of the tergite, more distinct on the sternites; segments 5 to 7 dark basally, their tips broadly paler,

the remaining segments passing into brownish black; hypopygium dark, even the outer dististyle dusky except at extreme base. Male hypopygium with the ninth tergite gently concave, setiferous laterally, the median area nearly glabrous. Outer dististyle elongate, terete, a little dilated outwardly, approximately twice as long as the inner dististyle. Inner style yellowish at base, the remainder infuscated, the apex resembling the head of a bird, the apical subchitinized beak slender but obtuse at tip, the crest of the head very high; both inner and outer margins of the style narrowly blackened.

Hab. Victoria.

Holotype, ♂, Tyers (*Miss Jean Galbraith*).

Paratype, ♂, Eltham, April 14, 1925 (*G. F. Hill*).

Type in the collection of the National Museum, Victoria.

Dolichopeza palliditarsis, sp. n.

General coloration dark brown, the præscutum with three brownish-yellow stripes; legs dark brown, the apices of the tarsi obscure yellow, more extensive on the posterior tarsi; wings tinged with brown; cell M_1 deep; abdominal segments brown, the basal sternites ringed with yellow; male hypopygium with the ninth tergite having two broad obtuse lobes, the notch between U-shaped; outer dististyle of moderate length, cylindrical, untoothed.

Male.—Length 9 mm.; wing 10.5–11 mm.

Female.—Length 12 mm.; wing 13 mm.

Frontal prolongation of head brownish yellow to yellow, in cases darker medially; palpi dark brown. Antennæ with the scapal segments yellow, the flagellum brownish black; if bent backward extending to the base of the abdomen or slightly beyond. Head brown, the anterior portions more yellowish, in cases with a capillary median darker line.

Pronotum dark brown. Mesonotal præscutum dark brown with three brownish-yellow stripes that are sometimes poorly delimited against the ground-colour, in other cases more conspicuous; remainder of mesonotum testaceous-brown to dark brown. Pleura testaceous-yellow, the dorso-pleural region somewhat darker; posterior region of the pleurotergite darker. Halteres elongate, testaceous, the base of the stem narrowly obscure yellow, the apex of the knob dark brown. Legs with the coxæ testaceous; trochanters yellow, with the usual black spot on the mesal face; remainder of legs dark brown, the extreme base paler; terminal three tarsal segments fading into pale yellow, on the hind legs

brighter and more extensive, including the apex of segment 2. Wings with a strong brownish tinge, the large stigma dark brown; a paler brown seam on the anterior cord; a conspicuous oblitative area at the fork of M ; veins dark brown. Macrotrichia beyond the cord long and conspicuous. Venation: R_s pale, in transverse alignment with the remaining elements of the anterior cord; R_{2+3} about two-thirds R_3 alone; cell M_1 deep, approximately two and one-half to three times its petiole; $m-cu$ about two-thirds its length before the fork of M .

Abdominal tergites dark brown, the basal segments paler; tergites 2 to 4 with a pale lateral spot, the remaining tergites dark brown; basal sternites light brown, ringed with yellow, the outer segments darker with the caudal margins broadly pale; hypopygium yellowish brown. Male hypopygium having the tergite with a broad obtuse lobe on either side of a deep U-shaped median notch, the lobes much wider than the notch, pale in colour. Outer dististyle cylindrical, unarmed, of moderate size only, much shorter than in *D. longidigitalis*, Alexander, and allies, the base narrow, the remainder of the style cylindrical. Inner dististyle about one-half the length of the outer, broadest at base, thence narrowed to the obtuse paler apex, the style with the outer margin darkened, setiferous, with a subapical black spine; mesal face near base of style with a low setiferous tubercle.

Hab. Tasmania.

Holotype, ♂, Fern Trec, Mt. Wellington, November 11, 1922 (*A. Tonnoir*).

Allotype, ♀, Cradle Valley, January 13, 1923 (*A. Tonnoir*).

Paratypes, 2 ♂ ♀, Cradle Valley, January 20-24, 1923; 1 ♀, Zeehan, February 7, 1923 (*A. Tonnoir*).

Dolichopeza subposticata, sp. n.

General coloration dark brown, the anterior portion of the præscutum abruptly paler; pleura yellow, with brown areas on the anepisternum and sternopleurite; legs dark brown, the posterior tarsi white; wings with a dusky tinge, with pale areas before and beyond the stigma; abdomen dark, ringed with pale; male hypopygium with the ninth tergite bearing two very low lobes.

Male.—Length 7-7.5 mm.; wing 7.8 mm.

Female.—Length 8 mm.; wing 8.8 mm.

Frontal prolongation of head yellow; palpi brown. Antennæ elongate, if bent backward extending about to the

base of the third abdominal segment; scapal segments light yellow, flagellar segments brown. Head dark brown, the anterior part of the vertex and the occipital region more yellowish.

Pronotum brown. Mesonotal præscutum broadly obscure yellow to yellowish brown in front, the posterior two-thirds dark brown, the usual stripes nearly confluent in the darkened areas; scutum pale brown, the lobes extensively dark brown; scutellum obscure yellow, margined behind with dark brown; postnotum yellowish brown, somewhat darker laterally. Pleura yellow, the ancipisternum and ventral half of the sternopleurite brown, the dorsal half of the sternopleurite yellow, slightly pruinose, interrupting the brown band; meron slightly darkened ventrally. Halteres pale, the knobs dark brown. Legs with the coxæ and trochanters yellow; remainder of legs dark brown, the femoral bases narrowly paler; genua slightly paler; tarsi brown, the fore tarsi yellowish brown, the posterior tarsi with segments 2 to 5 abruptly white. Wings with a dusky tinge, the apices of the radial cells darker, the stigma conspicuously dark brown; extensive whitish areas before, beneath, and beyond the stigma; brown seams on the anterior cord and less distinctly on *m-cu*, *Cu*₁, and most of the other longitudinal veins; veins dark brown. Venation: *R*₂₊₃ relatively short, a little more than one-half longer than *m-cu*; cell *M*₁ of moderate length, more than twice its petiole; cell 2nd *A* narrow.

Abdominal tergites brownish black, segment 2 with a whitish area on either side beyond mid-length, this interrupted at the mid-line; tergites 2 to 4 dark with a whitish ring near mid-length of each; remaining tergites dark brown; sternites dark brown, the base and rings near base of sternites 2 to 4 and apices of sternites 5 to 7 broadly pale yellow; hypopygium dark, the outer dististyle pale. Male hypopygium with the caudal margin of the ninth tergite with two very low lobes, the space between scarcely emarginate. Outer dististyle of moderate length, pale, cylindrical. Inner dististyle dark, about two-thirds the length of the outer, the outer margin dark, roughened into a few teeth, including a large subapical spine.

Hab. Victoria, Tasmania.

Holotype, ♂, Burnie, Tasmania, October 26, 1922 (*A. Tonnoir*).

Allotype, ♀, Mt. Wellington, Tasmania, December 7, 1922.

Paratypes, ♂, Sassafas, Dandenong Range, Victoria,

October 20, 1922; 1 ♀, Mt. Field, Tasmania, December 18 1922 (*A. Tonnoir*).

Dolichocheza subposticata is allied to *D. niveitarsis*, Skuse, differing in the interrupted transverse brown band on the thoracic pleura and the dark coloration of the legs, with only the posterior tarsi distinctly white. The type-specimens were distributed under the chirotype name of *D. posticata*, but it now seems advisable to change this latter name, since, through a *lapsus*, Brunetti in a key to the Oriental species of the genus (*Fauna Brit. India, Dipt. Nematocera*, pp. 564–565, 1912) used the name *posticata* for *Dolichocheza postica*, Brunetti.

Dolichocheza pygmæa, sp. n.

1920. *Dolichocheza niveitarsis*, Riedel, *Arkiv för Zoologi*, 13, No. 14, 6; nec *Dolichocheza niveitarsis*, Skuse, *Proc. Linn. Soc. New South Wales*, (2) 5, 62 (1890).

Size very small (♂, length less than 5 mm.; wing less than 6 mm.); antennæ more than one-half the length of the body; pleura testaceous-brown, without distinct stripes; legs dark, the terminal tarsal segments white.

Male.—Length about 4.5 mm.; wing 5.5 mm.

Frontal prolongation of head and the palpi brownish testaceous. Antennæ (♂) elongate, if bent backward extending to beyond mid-length of the abdomen, brown throughout. Head dark brown.

Pronotum dark brown. Mesonotum light brown to reddish brown, the præscutum with a darker brown median stripe, the lateral margins paler; scutal lobes slightly darker. Pleura pale testaceous-brown, without clearly defined darker markings. Halteres pale, the knobs dark brown. Legs with the coxæ light reddish brown, the trochanters yellow; femora brown, the bases paler; tibiæ and basitarsi pale brown, the tips of the posterior basitarsi and the remaining tarsal segments snowy white. Wings faintly tinged with brown, the oval stigma darker brown, the costal region faintly yellowish; veins dark brown. Venation: cells M_1 , M_2 , M_3 , and M_4 all very deep, cell M_1 being from two and one-half to three times as long as its petiole.

Abdominal tergites dark brown, with lateral whitish spots, producing a ringed effect; sternites paler. Male hypopygium small, the tergite with two low submedian lobes which are obtusely rounded, the notch between broadly U-shaped; lateral angles of tergite conspicuous, projecting caudad beyond the level of the median lobe. Outer dististyle

simple, cylindrical, with long coarse setæ. Inner dististyle gently curved into a boomerang-shaped structure, the outer margin narrowly blackened and microscopically denticulate, the outermost tooth larger; a small obtuse blackened tooth shortly before the obtuse apex.

Hab. North Queensland.

Holotype, ♂, Malanda (*E. Mjöberg*).

Type in the writer's collection; other specimens in the Riedel collection and in the Riksmuseets, Stockholm.

This tiny fly was sent to me some years ago as an exchange from Mr. Riedel. Riedel indicates that there were numerous specimens in the Mjöberg collection, taken at Atherton and Malanda, North Queensland.

Genus *PLUSIOMYIA*, Skuse.

EUPUSIOMYIA, subgen. nov.

Frontal prolongation of head short and stout, with a distinct nasus, not in alignment with the remainder of the front as in the typical subgenus. Flagellar segments tripectinate. Postnotal pleurotergite with a conspicuous lateral tubercle. Legs relatively short and stout; tibial spurs long. Venation with *Rs* short, not much longer than cell 1st *M*₂; cell *M*₁ short-petiolate.

Type of the subgenus: *Plusiomyia nasalis*, Alexander (Australian Subregion).

Plusiomyia (Euplusiomyia) optima, sp. n., likewise belongs here.

Plusiomyia (Euplusiomyia) optima, sp. n.

General coloration reddish orange; head black; flagellar branches shorter than in *P. nasalis*; wings strongly tinged with brown; cell *M*₁ short-petiolate.

Male.—Length about 12.5 mm.; wing 12 mm.

Female.—Length 16–18 mm.; wing 13–15 mm.

Male. Frontal prolongation of head as in *P. nasalis*, not in alignment with the remainder of the front, dark brown; nasus small, but distinct; palpi dark brown. Antennæ with the basal flagellar segment long-unipetinate, the branch longer than the segment; flagellar segments 2 to 8 tripectinate, the basal paired branches about twice the length of the segment, much shorter than in the corresponding sex of *nasalis*; small subterminal branch shorter than the segment, gradually decreasing in length outwardly, subobsolete on the outer branched segment; terminal three flagellar segments simple, the ultimate longer than the penultimate;

scape yellow, the basal segment infuscated apically; flagellum brown. Head black, including the narrow vertical tubercle; occiput and anterior portion of vertex a little paler.

Pronotum orange-red. Mesonotum reddish brown, the præscutum with three stripes, the median stripe reddish, the lateral stripes and scutal lobes blackened; scutellum darkened; postnotal mediotergite obscure reddish, the basal half marked with black; pleurotergite produced into conspicuous tubercles. Pleura reddish, strongly infuscated, the dorso-pleural membrane obscure yellow. Halteres brown, the extreme base of the stem pale, the apices of the knobs paler. Legs with the coxæ reddish brown, more or less pruinose; trochanters reddish brown; femora orange, the tips conspicuously blackened; tibiæ black with approximately the basal two-fifths yellowish; tarsi dark brown. Wings with a strong brown tinge, the base and cells *C* and *Sc* darker brown; a brown seam along vein *Cu*; veins dark brown. Venation: *Rs* shorter than *R*₃; cell *M*₁ short-petiolate, the petiole a little less than one-half *m*; *m-cu* punctiform, just before mid-length of cell 1st *M*₂.

Abdominal tergites dull blackish, the basal half of tergite 2 and the narrow base of tergite 3 shiny obscure yellowish; hypopygium relatively small, brown; sternites obscure brownish yellow, segments 5 to 7 blackened.

Female.—Generally similar to the male. Frontal prolongation of head and nasus somewhat shorter; flagellar branches shorter; mesonotum and pleura not darkened; pale tibial bases including about one-half the segment; basal tergite reddish orange, narrowly darker medially; tergites 8 and 9 orange; valves of ovipositor elongate.

Hab. Victoria.

Holotype, ♂, without exact data.

Allotype, ♀, Ferntree Gully, Dandenong Range, November 20, 1914 (*F. P. Spry*).

Paratypes, 1 ♀; 1 ♀, Emerald, November 23, 1903 (*Mrs. G. Coghill*).

Type in the collection of the National Museum, Melbourne.

Plusiomyia clarki, sp. n.

General coloration of thorax yellowish grey, the præscutum with three brown stripes; antennæ elongate, with very long branches; first scapal segment about one-half the length of the first flagellar segment; wings tinged with dusky; cell

R_2 relatively small, at wing-margin much narrower than cell R_3 ; abdomen dark brown, the basal tergites and the sternites yellowish.

Male.—Length about 10.5 mm.; wing 11.2 mm.; antenna about 7.5 mm.

Frontal prolongation of head relatively long, nearly as long as the remainder of the head, brown, paler beneath; palpi brownish black. Antennæ elongate, with very long slender branches; scapal segments small, the first of moderate length only, not more than one-half the length of the first flagellar segment; basal flagellar segment with a single branch placed at near one-third the length of the segment; following seven segments with two very long basal branches and an additional branch that is about two-thirds as long placed near mid-length of the segment on the same plane; ninth flagellar segment very long, with the two basal branches only, these approximately as long as the segment; terminal segment relatively small, less than one-sixth the penultimate, apparently formed by the fusion or close approximation of two segments, the antennæ thus appearing only 12-segmented, the formula being $2+9+1$; scapal segments obscure yellow; flagellar segments dusky at base, all branches dark, the apices of the segments narrowly yellow, the amount decreasing on the outer segments, the terminal two being entirely dark. Head buffy brown, with a narrow dark median vitta. Vertex between the eyes produced into a very high and conspicuous nasiform tubercle, strongly compressed, the antennæ placed close together on its lateral anterior face.

Pronotum very narrow, collar-like, dark brown. Mesonotal præscutum yellowish grey with three brown stripes, the median stripe divided by a capillary paler vitta; scutum grey, each lobe with two contiguous brown spots; scutellum and postnotum light grey. Pleura grey, the pleurotergite paler, the protuberance evident. Halteres elongate, brown, the base of the stem narrowly obscure yellow. Legs with the coxæ yellowish buffy, the middle coxæ dusted with light grey; trochanters obscure yellow; femora brown, the bases narrowly yellow, the tips more broadly blackened; tibiæ brownish testaceous, the tips darker, the bases brighter, more yellowish; basal two tarsal segments testaceous-brown, the tips narrowly darker; remaining tarsal segments dark brown. Wings with a strong dusky tinge, the costal region darker; stigma small and narrow, dark brown; veins brown. Venation: cell R_2 relatively small, vein R_3 being short and

deflected cephalad at its tip, so cell R_3 is much wider at wing-margin than cell R_2 ; cell M_1 narrowly sessile; cell 2nd A wide.

Abdomen with the basal three tergites yellow, with a conspicuous black lateral stripe beginning at the base of the second segment, becoming broader behind; a similar black median stripe begins beyond the base of the second segment, widening behind, restricting the yellow ground-colour; on the third segment the yellow is more suffused with brown and little evident; tergites 4 to 8 black; hypopygium brownish yellow; sternites yellow with a narrow brown median vitta that becomes wider on the fifth segment, on the sixth to eighth sternites suffusing the segments. Male hypopygium with the ninth tergite obscure yellow, the apical half darker, with conspicuous black setæ; caudal margin of the tergite with a narrow U-shaped median notch, the lateral lobes thus formed broadly truncated; ninth sternite extensive, produced into a point at caudal end.

Hab. West Australia.

Holotype, ♂, Albany (*J. Clark*); Ferguson No. 61.

Named in honour of the collector, Mr. John Clark.

Platyphasia eximia, sp. n.

General coloration reddish brown, grey-pruinose; head black, the anterior vertex silvery; antennæ black throughout; legs black, the femoral bases reddish fulvous; all tibiæ with a broad conspicuous yellow ring shortly beyond the base; wings tinged with blackish; abdominal tergites 2 to 5 black, 6 to 9 more reddish, with heavy patches of golden pollen on the sides.

Male.—Length 17–18 mm.; wing 16.5–18 mm.

Frontal prolongation of head light to darker brown, longer than the remainder of the head; palpi black. Antennæ black throughout, 13-segmented, with seven branched segments, the formula being 2+1+7+3, the branches placed at the extreme bases of the segments; first flagellar segment shorter than those that follow, unbranched; succeeding segments gradually increasing in length to the last branched one which is only a little shorter than its branch; first simple segment beyond about one-half the length of the last branched segment. Head short, black, the centre of the vertex with a narrow silvery line; anterior vertex before the antennæ silvery pruinose.

Pronotum very narrow, reddish brown. Mesonotal præscutum buffy with three reddish-brown stripes that

almost cover the surface, restricting the ground-colour to narrow interspaces that are widest at the suture and broad lateral margins; in the paratype, the reddish stripes are narrowly margined with darker brown; interspaces provided with yellow setæ of moderate length; pseudosutural foveæ small, blackened; scutum grey, each lobe with a triangular reddish mark, continuous with the lateral præscutal stripe; scutellum and postnotum sparsely pruinose. Tubercles of the pleurotergite conspicuous. Pleura heavily grey pruinose, the dorso-pleural membrane dusky. Halteres brown, the knobs darker with a small yellowish apical spot. Legs with the coxæ reddish, heavily pruinose; trochanters reddish brown; remainder of legs black, the femoral bases reddish fulvous, narrowest on the fore legs, broadest on the hind legs; all tibiæ with a broad yellow ring shortly beyond the base, this ring subequal in extent on all the legs and including from one-third (fore tibia) to one-fourth (hind tibia) the total extent. Wings with a strong blackish tinge, the prearcular and costal regions darker; in the type, cell *C* is paler, infumated near *h*; stigma very small, darker brown; veins dark brown. Venation: R_1 meeting R_{2+3} shortly before the fork; R_s elongate, fully one-half longer than R_{2+3} ; cell M_1 short-petiolate; cell 1st M_2 large, pentagonal, *m-cu* near mid-length; cell 2nd A relatively narrow.

Abdominal tergite 1 reddish brown, heavily pruinose; tergites 2 to 5 black, each with two patches of dense golden pollen on the sides, the basal patch smaller; on the fifth segment the pollen includes the whole basal half of the segment; dorso-median line less distinctly grey pruinose; sixth and succeeding segments rich reddish fulvous, with lateral golden pollinose areas; sternites reddish, segments 3 to 5 more pruinose.

Hab. New South Wales.

Holotype, ♂, Blackheath, Blue Mts., February 26, 1922 (*E. W. Ferguson*); Ferguson No. 62.

Paratype, ♂, Gosford, April 5, 1924 (*E. W. Ferguson*).

Habromastix novella, sp. n.

Head and thorax buffy, variegated with dark brown; wings dusky, the costal region slightly darker; abdomen orange.

Female.—Length 18 mm.; wing 15 mm.; abdomen alone 15 mm.; antenna about 4.8 mm.

Frontal prolongation of head a little shorter than the remainder of the head, dark brown, without a nasus; palpi

brownish black, the terminal segment nearly as long as segments 2 and 3 taken together. Antennæ setaceous; scapal segments light brown, the second more yellowish; flagellum dark brown, the base of the first segment pale. Head fulvous-yellow, the vertex with a conspicuous dark brown triangle, the point in front, the posterior orbits being very broadly of the ground-colour.

Pronotum dark brown, the collar-like posterior notum with a yellow spot on either side. Mesonotal præscutum obscure buffy yellow with three conspicuous dark brown stripes, the broad median stripe very vaguely divided by a pale line, the cephalic end expanded laterad as far as the pseudosutural foveæ; scutum buffy, each lobe with two large dark brown areas, the larger posterior spots connected across the median line; scutellum buffy, more infuscated in certain lights, the parascutella paler and less pollinose; postnotum whitish buffy with an inverted T-shaped marking. Pleura whitish buffy, paler behind, variegated with dark brown, this including most of the propleura, the dorsal pleurites, the ventral half of the anepisternum and sternopleurite, and the posterior portion of the pleurotergite immediately before the haltere; a small shiny pit-like area on the dorso-caudal margin of the anepisternum, a second on the suture between the sternopleurite and pteropleurite above the middle coxæ, a third area immediately above the middle coxa between the sternopleurite and meron. Halteres brown, the base of the stem obscure yellow. Legs with the coxæ extensively buffy, variegated with brown, especially the bases of the fore coxæ; trochanters obscure yellow; femora brownish testaceous, the tips darker; tibiæ testaceous, the tips narrowly darkened; tarsi beyond the base passing into dark brown; tarsi long and slender, the basitarsi longer than the tibiæ. Wings with a strong dusky tinge, the stigma, costal region, and cephalic prearcular region somewhat darker; a vague darker seam on the anterior cord; cell *C* and the apical portion of the wing in cells M_1 to M_4 with minute pale droplets; veins dark brown. Venation: *Rs* short, arcuated at origin, about two-thirds the straighter R_{2+3} ; venation otherwise much as in *H. robinsoni*, Alexander.

Abdomen orange, the basal tergite testaceous, the discal portion largely dark brown; genital segment darker, shiny reddish brown; ovipositor reddish horn-colour, the valves long and straight.

Hab. South Queensland.

Holotype, ♀, Eidavold, in yellow-pinch scrub, April 27, 1924 (T. L. Bancroft); Ferguson No. 63.

Distinguished from the allied *Habromastix robinsoni*, Alexander, by the smaller size, the conspicuously variegated head and thorax, and the short radial sector.

Phymatopsis tonnoirana, sp. n.

General coloration grey, the præscutum with three brownish-black stripes; female subapterous; wings of male fully developed, heavily spotted and clouded with brown; abdomen grey, the basal segments more reddish, especially in the male, the tergites with two intermediate dark brown stripes; genitalia of both sexes large and powerfully constructed.

Male.—Length 16–17 mm.; wing 16.5–17 mm.

Female.—Length about 23 mm.; wing 4.5 mm.

Male. Frontal prolongation of head long and slender, longer than the remainder of the head, entirely without a nasus, dark grey; palpi dark brown. Antennæ 12-segmented, brownish black, the basal segment of the scape pruinose, the second segment more reddish brown; flagellar segments cylindrical, gradually decreasing in length outwardly, the verticils relatively inconspicuous. Head buffy-grey, the vertex extensively dark brown, restricting the ground-colour to the relatively narrow posterior orbits.

Pronotum narrow, dark grey. Mesonotal præscutum grey with three conspicuous brownish-black stripes, the broad median stripe more narrowed behind, not reaching the suture, narrowly divided by a capillary line of the ground-colour, almost contiguous with the lateral stripes at the anterior ends of the latter, the interspaces strongly widened behind; pseudosutural foveæ small; scutum grey, each lobe with a brown triangular marking, paler behind, about touching a circular brownish-black spot in front; scutellum light grey, the parascutella darker; postnotum dark grey with a darker area in front on either side of the median line. Pleura light grey, the sternopleurite ventrally and a less clearly defined area on the anepisternum darker. Halteres reddish brown, the knobs darker. Legs with the coxæ light grey; trochanters fulvous; remainder of legs black, the femoral bases broadly fulvous, narrowest on the fore legs; basitarsi approximately as long as the tibiæ. Wings creamy-white with a heavy spotted and clouded brown pattern, the prearcular region and cell *Sc* more fulvous; stigma oval, darker brown; cells *R* and *R*₁ more uniformly

infumed; veins broadly seamed with brown; two darker brown clouds in cell *M* adjoining vein *Cu*₁, these sometimes completely crossing cell *M*; apices of the Anal cells broadly darkened; the pale ground-colour is thus most evident in the bases of the Anal cells; in cell *M*; on either side of the cord in the ends of cells *M* and 1st *M*₂ and the base of cell *R*₂; cell 2nd *A* is usually dark with two creamy spots; veins brownish black, paler in the yellowish areas. Venation: *Rs* long to very long, equal to or exceeding *R*₃, which, in turn, is more than one-half longer than *R*₂₊₃; cell *M*₁ short-petiolate to sessile; *m-cu* at about one-third the length of cell 1st *M*₂.

Abdominal tergite 1 and basal half of 2 reddish brown to cinnamon-brown, the first with two brownish spots; remaining tergites grey, with two submedian brown stripes extending from the posterior half of tergite 2 to tergite 8; sternites 1 and 2 reddish brown, the base of the latter with a brown median spot, the remaining sternites grey; hypopygium reddish brown. Male hypopygium very large and powerful, the sternite-basistyle elongate, the dististyles compressed, very large and conspicuous; outer dististyle densely hairy, the subequal inner dististyle with the mesal face likewise hairy, the dorsal margin with a row of about eight scattered black spinous teeth.

Female. Generally similar to the male, but differing in several regards, chiefly sexual or correlated with the sub-apterous condition.

Legs short and stout, the tibiae not longer than the basitarsi. Wings reduced to narrow strap-like organs, the venation very distorted; prearcular region very extensive, occupying only a little less than the basal half of the entire wing and a little paler in colour, the disk of the wing rather uniformly dark brown. Abdomen about as in the male, but the reddish coloration of the basal segments more restricted. Ovipositor with the dorsal shield blackened; valves dark reddish horn-colour, very powerful, the tergal valves especially highly compressed, with a sharp dorsal ridge; tips of the tergal valves curved gently laterad; sternal valves approximately as long, likewise powerfully constructed, bent dorsad at the tips.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 19, 1923 (*A. Tonnoir*).

Allotopotype, ♀.

Paratopotypes, 10 ♂♂, January 13–26, 1923 (*A. Tonnoir*).

This remarkable fly is named in honour of my friend and colleague, Dr. A. L. Tonnoir, who collected the type-series.

I am indebted to Dr. Tonnoir for the following notes on the occurrence :—

“This was found in the pupal state when digging for larvæ in the ground near the accommodation house on the Cradle Mountain. The males emerged at the end of my stay there and the female when I had already left.”

Ischnotoma skuseana, sp. n.

General coloration grey, the præscutal stripes margined with dark brown, the median stripe divided by a capillary darker brown vitta; flagellar segments strongly serrate in both sexes; wings whitish subhyaline, handsomely clouded with brown; a complete angulated white cross-band beyond the cord; cell R_2 small; abdomen orange-yellow basally, the subterminal segments black, the hypopygium light brown.

Male.—Length 13–14 mm.; wing 15–16 mm.

Female.—Length 15–16 mm.; wing 17 mm.

Frontal prolongation of head black, with a narrow obscure yellow stripe on either side, the nasus and palpi black. Antennæ black, only the extreme tips of the scapal segments a trifle paler; antennæ 12-segmented in both sexes; in the male flagellar segment 1 elongate, exceeding segments 2 and 3 taken together; remaining segments gradually decreasing in length; flagellar segments 2 to 8 with the lower face produced into a triangular tooth to give the organ a strongly serrated appearance; terminal two segments simple, nearly equal in length, the last a trifle more slender; in the female, the first flagellar segment is even longer, nearly as long as the following three segments taken together, the serrations conspicuous but scarcely involving segments 1 to 3 or the last, very conspicuous on flagellar segments 5 to 9. Head dark brown, the vertical tubercle not at all brightened, the orbits narrowly but conspicuously bordered with buffy-grey; occipital region with two small paler spots.

Pronotum narrow, dark brown, pruinose, especially laterally. Mesonotal præscutum grey to buffy with a broad median stripe of reddish brown that becomes darker behind; in the paratype male the stripe becomes buffy-yellow behind on either side of the median line; median stripe divided by a relatively broad dark brown median vitta and margined laterally by slightly narrower paler brown vittæ; lateral stripes grey, margined with dark brown, the mark encircling the anterior end of the stripe; in cases, a dark spot on lateral margin of the sclerite; pseudosutural foveæ punctiform; scutum brown, each lobe with two blue-grey spots

that are encircled with darker brown, the posterior lateral region of the lobes similarly blue-grey; scutellum relatively narrow and protuberant, grey, dark brown medially; postnotum clear light grey with an elongate dark brown triangle, the point directed backward. Pleura grey with indications of darker stripes on the sternopleurite and more dorsally across the anepisternum; anterior dorsopleural membrane, surrounding the spiracle, yellow, the more extensive posterior portion brown. Halteres yellow, the knobs dark brown. Legs with the coxæ light grey; trochanters yellowish brown, the posterior trochanters darker; femora obscure fulvous-yellow, the tips narrowly blackened; in the female, the fore femora darker; tibiæ similar, the tips very narrowly blackened; tarsi brown, passing into black on the outer segments. Wings whitish subhyaline with a handsome brown pattern; extreme base of wing yellow, the main prearcular region whitish; stigma yellowish brown; the brown marks include the wing-tip, this more or less invaded by pale washes in the cells, this dark apex preceded by a complete white angular cross-band extending from the costal margin in cell R_2 to the caudal margin in cell M_3 ; paler brown clouds in the costal region before the origin of R_s , extending across cell R , more extensive but paler in cell M ; an extensive cloud in the ends of cells M , Cu , and the extreme tip of 1st A ; other pale clouds in the outer end of cell 1st A at mid-distance between the veins and in cell 2nd A beyond mid-length of the cell; prearcular region in cell Sc , a triangular prearcular spot and a small spot at the proximal end of the stigma darker brown; veins dark brown, paler in the subhyaline areas, the obliterative areas at the cord extensive. Venation: vein R_3 sinuous, its distal portion bent strongly cephalad so cell R_2 is unusually small, at the margin only about two-thirds as wide as cell R_3 ; cell 1st M_2 elongate; petiole of cell M_1 variable in length, from much longer to much shorter than m .

Abdominal segment 1 light brown; segments 2 and 3 orange-yellow, narrowly darker sublaterally, in cases with a median dark vitta; on the succeeding tergites the colour deepens, on segments 5 to 8 black; hypopygium light brown. In the female, the general coloration of the abdomen tends to be more obscure. Ovipositor with the tergal basal shield shiny obscure yellow, the valves brownish yellow, their bases and tips dark.

Hab. Tasmania.

Holotype, ♂, Fern Tree, Mt. Wellington, November 11, 1922 (*A. Tonnoir*).

Allotopotype, ♀.

Paratypes, ♂, Adventure Bay, December 29, 1922 (*A. Tonnoir*); ♀, Mt. Wellington, November 25, 1922 (*A. Tonnoir*); 1 ♂, 1 ♀, Mt. Wellington, January 1924 (*G. H. Hardy*), in the Queensland University Collection.

This very distinct crane-fly is named in honour of the late Frederick A. A. Skuse, great pioneer student of the Tipulidæ of Australia.

Ischnotoma terminata, sp. n.

Size small (length, ♀, about 12 mm.); antennæ strongly serrate, the terminal segment elongate; general coloration grey, the præscutum with three dark brown stripes; wings with a strong brown tinge, with subhyaline areas before the stigma, the outer end of cell *M*, and the bases of cells 2nd *M*₂ and *M*₄; cell *R*₂ uniformly dark; abdomen dark greyish brown, the caudal margins of the sternites and outer tergites narrowly pale.

Female.—Length about 12 mm.; wing 12.7–13 mm.

Generally similar to *I. prionocerooides*, Alexander (Tasmania), from which it differs especially in the smaller size and the elongate subuliform terminal segment of the strongly serrated antennæ.

Antennæ strongly serrate, especially flagellar segments 3 to 9, more markedly produced on flagellar segments 6 to 8; terminal segment elongate, nearly as long as to longer than the first flagellar segment. Head brown, the anterior vertex and the orbits narrowly clear grey, the latter widening out beneath.

Pronotum grey. Mesonotal præscutum grey with three broad dark brown stripes, the broader median stripe sometimes narrowly pruinose in front, with a barely indicated still darker vitta; posterior interspaces suffused with brown; scutum clear grey medially, each lobe with two contiguous dark brown areas; scutellum and postnotum clear light grey, the latter without or with bare indications of a darker marking. Pleura light grey, the sternopleurite, meron, and a narrow line across the ventral portion of the anepisternum darker grey; meron protuberant. Halteres light brown, the base of the stem narrowly darker, the knobs pale. Legs with the coxæ and trochanters dark, heavily grey pruinose; remainder of legs brownish black, the femoral bases obscure fulvous, narrowest on the fore femora where less than the basal third is included, widest on the posterior femora where about the basal two-thirds is included; only the bases of the

tibiæ are slightly brightened. Wings with a strong brownish tinge, the stigmal region darker; subhyaline areas distributed as follows: before the stigma in cell R_1 ; in the outer end of cell M ; bases of cells $2nd\ M_2$ and M_4 ; bases of cells $1st\ A$ and $2nd\ A$; centres of cells M_1 and M_3 vaguely paler; cell C slightly darker brown than the ground-colour; cell Sc a little more yellowish brown; veins dark brown, the oblitative areas extensive. Venation: Rs relatively elongate; cell $1st\ M_2$ elongate, parallel-sided; petiole of cell M_1 shorter than m ; cell $2nd\ A$ wide.

Abdominal tergites dark greyish brown, the extreme caudal margin of tergite 7 narrowly pale; in one of the paratypes the margins of segments 5 and 6 are slightly pale; sternites dark greyish brown, the caudal margins of the segments ringed with pale, the amount increasing on the outer segments, broadest on sternite 7. Ovipositor with the basal shield dark, shiny, the straight slender tergal valves horn-coloured.

Hab. Tasmania.

Holotype, ♀, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Paratypes, ♀, Mt. Field, December 18, 1922; ♀, Mt. Wellington, November 30, 1922 (*A. Tonnoir*).

Ischnotoma tarwinensis, sp. n.

Antennæ simple in both sexes; general coloration grey, variegated with dark brown, the præscutum with four brown stripes; wings with a brownish-yellow tinge, the stigma darker; abdomen obscure orange, the terminal segments darker; male hypopygium with the tergite large, with a very deep median notch.

Male.—Length about 12.5 mm.; wing 15 mm.

Frontal prolongation of head of moderate length, approximately as long as the remainder of the head, narrowly dark grey above, the sides and ventral portions of the front obscure brownish yellow; palpi black; nasus long and conspicuous. Antennæ very short, about two-thirds the total length of the head, 12-segmented, the basal segment elongate, slightly constricted near mid-length; basal six flagellar segments stouter, subcylindrical, gradually decreasing in length and diameter outwardly; terminal four segments very slender, the last elongate, only a little shorter than the preceding two taken together; scapal segments brown, the first pruinose above, the second darker; flagellum black, with conspicuous verticils. Head greyish brown, the anterior portion of the vertex conspicuously darker brown, the

frontal prolongation and the orbits narrowly margined with light grey.

Pronotum grey, brighter, more brownish, dorsally, the sclerites very thin and plate-like. Lateral pretergites obscure orange, narrow. Mesonotal præscutum yellowish grey, brighter laterally, with four long dark brown stripes, the intermediate pair separated from one another by a capillary reddish-grey line, the lateral stripes separated from the intermediates by a slightly wider dark grey line; pseudo-sutural foveæ punctiform; scutum brownish grey, each lobe almost covered by two confluent dark brown spots; scutellum black, pruinose, with an elongate-oval reddish spot in middle, parascutella yellow; postnotum light grey with a conspicuous dark brown triangle, the point directed caudad but not quite attaining the caudal margin. Pleura clear light grey, the dorso-pleural membrane brownish yellow; pleurotergite brown, sparsely pruinose, more heavily so ventrally. Halteres dark brown, the stem narrowly reddish brown at base. Legs with the coxæ pale, heavily light grey pruinose; trochanters fulvous-yellow; remainder of legs black, the basal two-thirds of the femora dark fulvous; basitarsi much longer than the tibiæ. Wings with a brownish-yellow tinge, the extreme base bright orange; stigma yellowish brown, the proximal end darker brown; cell *Sc* more yellowish brown, but cell *C* entirely clear; wing-apex in cells R_2 and R_3 a little darkened; a narrow dusky seam along veins Cu_1 and $m-cu$; veins black, with conspicuous obliterative areas at end of R_s and across the proximal end of cell 1st M_2 . Venation: R_{2+3} about four-fifths R_s ; R_{1+2} complete, R_2 about in alignment with the apex; cell R_2 relatively small, cells R_2 and R_3 at wing-margin being sub-equal in extent; petiole of cell M_1 a little longer than m ; $m-cu$ on M_{3+4} shortly before its fork.

Abdominal tergites obscure orange, the sides of tergite 1 dark brown, leaving a median triangle of the ground-colour, the terminal segments a little darker, more reddish brown; sternites similar, the base of the eighth sternite a little darker. Male hypopygium reddish brown, of moderate size and length. Ninth tergite large, with a deep and narrow median notch, the lateral lobes thus formed conspicuous; surface of tergite on distal half with abundant short black setæ. The fused sternite and basistyle projects caudad slightly beyond the level of the tergite, provided with sparse black setæ that become longer and light yellow on the caudal portions; suture between basistyle and sternite indicated beneath. Dististyle flattened, elongate, the dorsal portion

margined with a crown of about a dozen small black teeth, the long apical beak jutting into the notch of the tergite. Eighth sternite unarmed.

Hab. Victoria.

Holotype, ♂, Lower Tarwin, November 22, 1925 (G. F. Hill).

Type in the collection of the National Museum, Victoria.

Macromastix igniceps, sp. n.

Male.—Length about 10 mm. ; wing 14.5 mm.

Generally similar to *M. aurantioceps*, Alexander (New South Wales), differing as follows:—

Frontal prolongation of head entirely fiery orange; nasus relatively conspicuous, a little darker in colour. Head fiery orange, more intense behind, the vertex wide, just behind its narrowest point a somewhat darker suffusion on the orbits.

Pronotum narrower. Mesonotal præscutum entirely dull light buffy brown, with three conspicuous dark brown stripes, the median stripe narrowly split by a capillary paler vitta; pseudosutural foveæ punctiform, with a curved line from the margin extending through the fovea; thence directed anteriorly; remainder of mesonotum pale buffy brown; scutal lobes almost covered by a dark brown marking prolonged across the suture from the lateral præscutal stripes. Pleura fulvous-yellow, without evident pruinosity. Halteres dark brown, the extreme base of the stem narrowly paler. Legs with the coxæ concolorous with the pleura; trochanters obscure yellow; femora yellow, the tips broadly blackened, especially on the fore femora where more than the distal third is included, narrowest on the posterior femora where about the distal fifth is included; tibiæ and basitarsi brown, darkened distally; remainder of tarsi black. Wings with a strong brownish-yellow tinge, the stigma and costal region darker, the costal cell a little brighter than the subcostal; veins dark brown. The left wing of the type shows paler washes in cells R_5 to $2nd\ M_2$; the right wing similar washes in the Anal cells. No pale spots before and beyond the stigma and the usual bullate areas on the cord not evident. Venation: R_s short and straight, a little shorter than R_{2+3} ; R_3 about one-half longer than R_{2+3} ; cell M_1 short-petiolate to nearly sessile; cell $2nd\ A$ relatively narrow.

Abdominal tergites obscure orange, the black triangles extensive, each produced anteriorly so as to form a complete

or nearly complete dorso-median stripe; extreme margins of the tergites narrowly blackened; sternites orange, the outer sternites darker medially; eighth segment entirely dark brown; hypopygium yellow. Male hypopygium with the caudal margin of the tergite gently emarginate, the margins of the very short lobes densely fringed with short setæ, the surface of the lobes with long conspicuous setæ. Outer dististyle flattened, extended into a slender point, the outer margin before this elongate point with a shorter conical tooth; surface of style with numerous long conspicuous setæ from conspicuous tubercles. Inner dististyle with the caudal margin expanded into a flattened wing or flange, the base or lateral portion further produced into a sharp spinous prolongation; apex of style produced mesad into a stout gently curved arm that is terminated by several stout spinous setæ. Neither of the dististyles are provided with true spines.

Hab. Tasmania.

Holotype, ♂, Burnie, February 1, 1923 (*A. Tonnoir*).

Macromastix nigropolita, sp. n.

Head dark grey; mesonotal præscutum and the scutal lobes shiny polished black, the remainder of the notum obscure yellow; mesopleura pruinose; tips of femora narrowly blackened; wings with a strong brownish tinge, the prearcular region more yellowish; abdomen yellow, the tergites trilineate with black, the sternites with a median black stripe; abdominal segments 6 and 7 entirely black; genitalia yellow.

Female.—Length about 9 mm.; wing 11.5 mm.

Frontal prolongation of head relatively short, dark brown above, obscure yellow beneath; nasus elongate, brownish black; palpi brownish black. Antennæ very short, only about as long as the head, 12-segmented; basal segment of flagellum enlarged, much stouter and longer than the next, the succeeding segments cylindrical, gradually decreasing in length and diameter, the terminal segment a little longer than the penultimate; scapal segments pale, a little darker above; flagellar segments beyond the second blackened. Head dark grey, paler grey in front, the area surrounding the antennal fossæ yellow; vertical tubercle scarcely developed.

Pronotum obscure yellow. Mesonotal præscutum shiny coal-black, highly polished, the very restricted humeral region and lateral margins a trifle paler; interspaces not different in colour, indicated only by a few short setæ behind;

suture pale; scutum obscure yellow, the antero-mesal half of each lobe entirely shiny coal-black, the median area of the scutum obscure brownish yellow; scutellum and post-notum obscure yellow, the posterior margin of the mediotergite with two confluent shiny black spots. Pleura pale, the propleura, anepisternum, sternopleurite, and ventral portion of the meron infuscated and conspicuously pruinose; pleurotergite more shiny, the ventral margin narrowly blackened. Halteres short, pale, the knobs more infuscated. Legs with the coxæ obscure yellow, very sparsely pruinose; trochanters obscure yellow; femora yellow, the tips narrowly but very conspicuously blackened, the amount subequal on all the legs; tibiæ pale brown, the bases narrowly, the tips more broadly blackened; tarsi black; tarsi slender, the basitarsi considerably longer than the tibiæ. Wings with a strong brownish tinge; prearcular region more yellowish; costal region a trifle darker than the ground-colour; stigma oval, darker brown; veins dark, the prearcular veins yellow. Venation: *Rs* straight, subequal to or a trifle shorter than R_{2+3} ; cell M_1 short-petiolate; cell 2nd *A* narrow.

Abdominal tergites yellow with a broad continuous black median stripe that widens out at the posterior margins of segments 2 to 5, tergite 6 being entirely black; tergite 7 black except for a restricted pale margin on either side of the median line; tergites 8 and 9 obscure yellow; lateral margins of the tergites narrowly blackened, more broadly so on segments 2 and 3; sternites bright yellow with a median black stripe, on sternite 2 represented by two isolated spots; on sternites 3 to 5 continuous; sternites 6 and 7 entirely black; sternite 8 yellow. Ovipositor with the valves very short and blunt, as in the genus, the tergal valve single with a small caudal notch.

Hab. New South Wales.

Holotype, ♀, Mt. Wilson, Blue Mts., November 19, 1921 (*A. Tonnoir*).

Macromastix mutabilis, sp. n.

General coloration of thorax of male buffy, with fulvous stripes, of the female darker brown; antennæ short in both sexes; centre of the vertex infuscated; wings with a brown tinge, the costal and prearcular regions darker; petiole of cell M_1 longer than *m*; abdominal tergites with two rows of dark spots that are sometimes expanded into interrupted sublateral stripes.

Male.—Length about 8.5–9 mm.; wing 12.8–13.5 mm.

Female.—Length about 8 mm. ; wing 13·3 mm.

Male. Frontal prolongation of head relatively short, less than the remainder of the head, brownish yellow ; nasus short and stout ; palpi dark brown. Antennæ short, brown, the basal segment more pruinose ; flagellar segments gradually decreasing in size, the first largest, subpyriform, the succeeding three segments cylindrical, the remainder linear. Head buffy-yellow, the centre of the vertex infuscated, sending a narrow line cephalad on to the vertical tubercle.

Mesonotum buffy, the præscutum with four slightly darker fulvous stripes, the intermediate pair barely separated by a line of the ground-colour ; scutum greyish buff, the lobes more ferruginous ; scutellum and postnotum darker, sparsely pruinose, the posterior margin of the latter with two lateral paler triangles. Pleura buffy. Halteres pale brown, the base of the stem buffy. Legs with the coxæ and trochanters buffy yellow ; femora brownish yellow, the tips narrowly dark brown ; tibiæ yellowish brown, the tips narrowly infuscated ; tarsi passing into dark brown. Wings with a brownish tinge, the costal region, and especially cell *Sc*, darker brown, this clouding including the base of cell *R* and the preareolar region ; stigma darker brown ; a brown cloud on the anterior cord ; veins darker brown ; obliterative areas distinct ; a pale streak in outer end of cell *R* and the base of cell 1st *M*₂. Venation : *R*₃ nearly straight, about one-half longer than *R*₂₊₃ ; petiole of cell *M*₁ longer than *m* ; cell 1st *M*₂ relatively small, irregularly pentagonal ; cell 2nd *A* relatively narrow.

Abdominal tergites buffy, beyond the first with a dark sublateral spot on either side, those on the posterior segments more extensive ; segments 7 and 8 uniformly darkened ; sternites pale ; hypopygium obscure yellow. Male hypopygium with the ninth tergite relatively large, the caudal margin with a broad but shallow V-shaped notch, the apices of the broad lobes thus formed with an extensive area that is densely set with erect spinous setæ ; further cephalad on the sclerite the setæ become longer and larger. A single complex dististyle, relatively large, the distal half expanded into a head, the beak being short, obtuse, the ventral portion protuberant, heavily blackened and armed with abundant black spines ; on the lateral face of the style a flattened glabrous wing-like expansion ; base of style with a large fleshy setiferous lobe on ventro-mesal face ; a narrow setiferous lobule at the extreme base, directed laterad and dorsad, this continuous with the wing-like expansion above described. *Ædeagus* long and slender.

In the paratype male the præscutum is an almost uniform fulvous, the stripes not evident.

Female. The females that are referred to this species are very different in general appearance from the males, but the association is believed to be correct. The head, thorax, and abdomen are largely brown, more pruinose on the pleura. Præscutum obscure buffy-yellow with four reddish-brown stripes that are narrowly margined with darker, completely obliterating the interspaces. Abdomen greyish brown, the caudal margins of tergites 2 to 5 brighter brown; sternites brownish testaceous. In the paratype female the same dark coloration is found, but the præscutal stripes are well separated, the median stripe paler in front. The sublateral spots on the abdomen are here so extensive as to form two interrupted dorsal stripes.

Hab. Tasmania.

Holotype, ♂, Adventure Bay, December 31, 1922 (*A. Tonnoir*).

Allotype, ♀, Strahan, February 6, 1923 (*A. Tonnoir*).

Paratopotype, ♀; *paratype*, ♂, with the allotype.

XLIII.—*The Orthoptera (excluding Blattidæ) of Rodriguez Island.* By B. P. UVAROV.

THE present list is based on the material in the general collection of insects made by Mr. H. P. Thomasset and Mr. H. J. Snell in Rodriguez from August to November 1918.

Previous records of Rodriguez ORTHOPTERA given by Butler† are also included in the list, while Butler's determinations have been checked after a re-examination of the original specimens. The species not recorded by Butler are marked with an asterisk.

The number of species known from Rodriguez is much too small to permit of any zoo-geographical remarks.

It may be added that the BLATTIDÆ of the Thomasset and Snell Collection are dealt with in a separate paper by Dr. Hanitsch, while the collection also includes a few DERMAPTERA, probably a single species, which cannot at present be determined.

† Phil. Trans. R. Soc. London, vol. 168 (extra volume), 1879, pp. 545-549.

Mantidæ.

1. *Polyspilota aeruginosa* (Goeze).

Mantis variegata, Olivier, Butler, l. c. p. 548.

One female and two larvæ.

Phasmidæ.

2. *Xenomachus incommodus* (Butl.).

Bacillus incommodus, Butler, l. c. p. 548.

Not in the collection before me.

Gryllidæ.

3. *Nemobius* (?) *luteolus*, Butl.

Butler, l. c. p. 547.

I am unable to verify the original generic assignation of this species, as the only type is a badly shrunk and discoloured female.

*4. *Liogryllus bimaculatus* (De Geer).

Gryllus capensis, Butler, l. c. p. 546 (nec F.).

Butler's determination of the species was incorrect. There are in the collection before me 3 ♂ ♂ and 4 ♀ ♀, as well as two larvæ, of this species.

*5. *Ornebius* sp.

One mutilated male of an apparently undescribed species.

6. *Mogoplistes* sp.

Butler, l. c. 546.

Two immature specimens, on which Butler's record was based, could not be traced.

*7. *Gryllotalpa africana* (Pal. Beauv.).

Three adults and three larvæ of this species, which is widely distributed in the tropics of the Old World.

Tettigoniidæ.

8. *Phisis spinifera*, Butler.

Butler, l. c. p. 547.

Not represented in the collection studied.

9. **Conocephalus (Xiphidion) obtectum*, Karny?*Xiphidium iris*, Butler, l. c. p. 547, partim (nec Serv.).

One female in the collection before me agrees fairly well with the description by Karny; I cannot, however, be quite certain in my determination, since Karny had only a male, which was collected in Réunion.

The measurements of the female are as follows: Length of body 14.5; pronotum 3; elytra 12; hind femur 13.5 mm.

10. *Conocephalus (Palotta) iris* (Serv.).*Xiphidium iris*, Butler, l. c. p. 547.

One male and one female recorded by Butler, and two females in the collection before me now.

11. *Homorocoryphus differens* (Serv.).*Conocephalus differens*, Butler, l. c. p. 547.

One male in the collection studied, not differing from the specimens recorded by Butler.

The specific determination is somewhat uncertain, the original description by Serville being inadequate.

Acrididæ.

12. *Aiolopus rodericensis* (Butl.).*Epacromia rodericensis*, Butler, l. c. p. 548.

Two males and five females (one immature) of this interesting species.

13. *Locusta migratoria*, L., ph. *danica*, L.*Pachytylus cinerascens*, Butler, l. c. p. 548.

Four males, one female, and three immature specimens.

All the specimens are rather small and resemble somewhat the form *australis*, Br. W., occurring in Fiji and New Zealand.

XLIV.—*The Blattidæ of Rodriguez.*

By R. HANITSCH, Ph.D.

THE island of Rodriguez, the Blattid fauna of which I propose to describe in the following pages, forms the S.E. corner of the Malagasy sub-region. Through Saussure and Zehntner's *

* A. Grandidier, 'Histoire physique, naturelle et politique de Madagascar,' vol. xxiii., "Histoire naturelle des Orthoptères, 1^{re} partie, Blattides et Mantides," par MM. H. de Saussure et Zehntner (Paris, 1895)

"Orthoptera" in Grandidier's work on Madagascar, and through Bolivar's* "Orthoptera Dictyoptera (BLATTIDÆ and MANTIDÆ) of the Seychelles and adjacent Islands," the result of the Percy Sladen Trust Expedition in 1905 and 1908-9, we are already well informed of the Blattid fauna of this sub-region. Bolivar's paper covers, besides the Seychelles, practically all the islands to the S.W. as far as, but omitting, Comoro, to the S. as far as Cargados, and on the E. even includes the Chagos Archipelago, though the last-named lies outside the strict limits of this sub-region. Of Réunion and Mauritius we have only stray records of Cockroaches, viz., *Temnopteryx abbreviata*, Sauss., from Réunion (Mém. Soc. Genève, xvii. p. 149, pl. i. fig. 13 (1864)), and of Mauritius *Chorisoblatta liturifera*, Stål, *Lupparia insularis*, Sauss., *Supella supellectilium*, Serv., *Nauphæta cinerea*, Oliv., *Holocompsa cyanea*, Burm., and *H. nitidula*, Fabr. Of these only *Chorisoblatta liturifera* and *Lupparia insularis* can be regarded as indigenous to that island, as the two species of *Holocompsa* are New World forms and were, no doubt, accidentally introduced into Mauritius, whilst *Supella supellectilium* and *Nauphæta cinerea* are practically cosmopolitan.

The only published list of the Blattidæ of Rodriguez is that by Butler †, from material collected during the Transit of Venus Expedition, 1874-1875, in which he enumerates the following species:—

- Panchlora corticum*, Serville.
- Phyllodromia germanica*, L.
- Periplaneta americana*, L.
- Periplaneta rhombifolia*, Stoll.
- Polyzosteria latipes*, Walker.

The collection is preserved in the British Museum, where Dr. Uvarov has succeeded in tracing it, with the exception of *P. americana*. An examination of the collection by him and by myself shows that *Periplaneta rhombifolia* is, of course, *Stylopyga rhombifolia*, Stoll, and that both *Panchlora corticum* and *Polyzosteria latipes* are nothing but the cosmopolitan *Pycnoscelus (Leucophæa) surinamensis*, L. The

* Ign. Bolivar, "Orthoptera Dictyoptera (Blattidæ and Mantidæ), and Supplement to Gryllidæ of the Seychelles and adjacent Islands," Ann. & Mag. Nat. Hist. (9) vol. xiii. pp. 313-359 (1924).

† A. G. Butler, "Orthoptera and Hemiptera," in "An Account of the Petrological, Botanical, and Zoological Collections made in Kerguelen's Land and Rodriguez during the Transit of Venus Expedition, 1874-1875," Philos. Trans. Roy. Soc. vol. 168 (extra vol.), p. 545 (1879).

remaining one species, represented by a single example, has nothing to do with *Phyllodromia germanica*, L., and is described below under the name of *Murgattea* (?) *gulliveri*, sp. n.

Butler's meagre list can now be supplemented (i.) by a few specimens collected by Messrs. H. P. Thomasset and H. J. Snell, August to November, 1918, besides *Periplaneta americana* and *Pycnoscelus surinamensis*, including three species of *Theganopteryx* (subfam. ECTOBINÆ), each represented by a single example only, and (ii.) by two species of *Murgattea* (subfam. PHYLLODROMINÆ), each also represented by one example only—old material from the University Museum of Zoology, Cambridge, labelled "Rodriguez, F. Sinclair," concerning which no other particulars are obtainable. I am indebted to Dr. Hugh Scott for submitting to me all this material.

The fact that the collection contains three species of *Theganopteryx* is very interesting. From Madagascar eight species* of this genus are known, and from the Seychelles six, but not a single one has been recorded from any of the intervening islands visited by the Percy Sladen Trust Expedition, viz. Coetivy, the Amirantes, Cosmoledo, Astove, Farquhar, Aldabra, Assumption, the Chagos Group, and Cargados. All these islands are small and low coralline atolls, differing greatly from the Seychelles and Rodriguez. Most of the material of *Theganopteryx* from the Seychelles is expressly recorded by Bolivar (from Scott's field-notes) as having been taken in high damp forest, at altitudes of 1000 to 2000 ft. Only one or two stray examples were taken in the drier, less endemic type of forest near the sea-level on Félicité Island. The island of Rodriguez, too, though only about 42 square miles in extent, rises to a comparatively considerable height, viz. 1300 ft., and was at one time clothed with virgin forest. Whilst it is thus explicable enough that *Theganopteryx* occurs in the Seychelles and on Rodriguez, and also in Madagascar—though in each case represented by different species,—but is absent from all the intervening coralline atolls, it is noteworthy that it has not yet been recorded from Réunion and Mauritius. Curiously enough, this agrees with the distribution of another group of insects on these islands. Hugh Scott, in his "Introductory Note" to F. W. Edwards's paper on the "Diptera Nematocera from Rodriguez Island" (Ann. & Mag. Nat. Hist.

* *T. conspersa*, S., *T. difficilis*, S., *T. punctata*, S., *T. bidentata*, S. and Z., *T. hova*, S. and Z., *T. malagassa*, S. and Z., *T. molesta*, S. and Z., and *T. tricolor*, S. and Z.; whilst *T. punctulata*, S. and Z., and *T. veltzkowiana*, S. and Z., seem to belong to the PHYLLODROMINÆ.

(9) xii. p. 330 (1923)), says: "Nearly all of the Rodriguez genera [of Diptera Nematocera] are represented in the Seychelles, but by different species: e. g., *Simulium* has a single species in Rodriguez and a single, quite distinct, representative in the Seychelles; *Probezzia* is represented in the Seychelles by four species, and in the Rodriguez collection by one species, quite distinct from any of those four." And again: "One would naturally seek for affinities with the fauna of Rodriguez in Mauritius and Réunion, which lie between 350 and 500 miles to the west, but I am not aware that any data are forthcoming with regard to the Nematocera of the last-named islands."

The distribution of the genus *Margattea* is also interesting and recalls, at least in some respects, that of *Theganopteryx*. Bolivar describes three species of *Margattea* from the Seychelles, viz., *M. crassivenosa*, *M. parvula*, and *M. longicercata*. One of these, viz., *M. longicercata*, occurs also on the Amirantes, Coetivy, Farquhar, Aldabra, and Cargados, and *M. parvula* also on Farquhar and Aldabra. A further species, *M. laxiretis*, is known from the Chagos only. However, none of these forms reaches Rodriguez, and the genus is there represented by two or three other species. And, as in the case of *Theganopteryx*, no species of *Margattea* has yet been recorded from Réunion and Mauritius.

The distribution of the other species hardly calls for special remark. *Periplaneta americana*, L., *Stylopyga rhombifolia*, Stoll, and *Pycnoscelus* (*Leucophæa*) *surinamensis*, L., which were taken on Rodriguez during the Transit of Venus Expedition, and then again by Messrs. Thomasset and Snell, are cosmopolitan forms, and are known also from the Seychelles and most of the "adjacent islands," but seem, curiously enough, not to have been recorded as yet from either Réunion or Mauritius.

The TYPES of this collection will all be preserved in the British Museum (Natural History).

LIST OF THE BLATTIDÆ KNOWN FROM RODRIGUEZ.

Ectobinæ :

Theganopteryx picturata, sp. n.

„ *snelli*, sp. n.

„ *thomasseti*, sp. n.

Phyllodromiinae :

Margattea sinclairi, sp. n.

„ *bilobata*, sp. n.

„ (?) *gulliveri*, sp. n.

Blattinæ :*Periplaneta americana*, L.*Stylopyga rhombifolia*, Stoll.**Panchlorinæ :***Pycnoscelus (Leucophæa) surinamensis*, L.**DESCRIPTIONS OF THE SIX NEW SPECIES.****1. *Theganopteryx picturata*, sp. n. (Fig. 1.)**

♂. Head only slightly free, testaceous, a small brown spot on the vertex, a larger, broad, triangular, brown spot above the antennal sockets; three narrow broken bands, also brown, across the face; antennæ (mutilated) light testaceous; eyes apart by $\frac{1}{3}$ the width of the head. Pronotum sub-elliptical, broadest behind the middle, slightly produced behind; disk light testaceous, with intricate, slightly asymmetrical markings of brown lines and dots; lateral margins broad, hyaline. Tegmina much exceeding the abdomen, pale testaceous, veins standing out as narrow

Fig. 1.

*Theganopteryx picturata*, sp. n., ♂.Pronotum, $\times 9$.

cream-white lines, interrupted by numerous small brown spots which are more crowded towards the apex; costal area broad, 12 costals of which the tenth and eleventh are ramose; 8 oblique discoidal sectors; anal sulcus not prominent, 5 anals, each interstice with two rows of minute brown pits. Wings pale fuscous; mediastinal vein bifurcate, 10 costals, the first eight simple, their ends somewhat incrassated, the 9th and 10th ramose; median vein simple, straight; ulnar 4-ramose; apical triangle large, fuscous; first axillary 4-ramose. Abdomen below testaceous. Subgenital lamina large, hexagonal. Cerci testaceous, the terminal joints alternating testaceous and black. Styles small, cylindrical, colourless. Legs pale testaceous; front femora on the anterior margin with about 3 large spines, followed distally by a series of minute piliform spines (type B).

♂. Total length 13 mm.; body 11 mm.; pronotum 3×4 mm.; tegmina 11 mm.

Loc. Rodriguez (*Thomasset and Snell*, viii.-xi. 1918), 1 ♂.

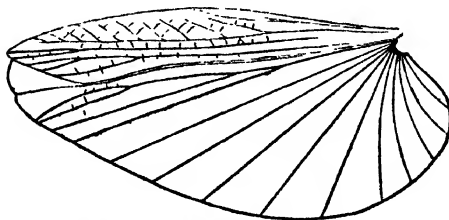
This species seems closely allied to *T. conspersa*, Saussure, from Madagascar ('*Societas Entomologica*, vi. (1891) p. 26; and Grandidier, *Hist. nat. Madagascar*, Orthoptera, 1895, p. 10), the type of which, however, I have not been able to see. Saussure describes the disk of the pronotum of *T. conspersa* as "orné de points et de lignes en arabesques, avec deux lignes longitudinales médianes, brunes," and the tegmina as spotted, which would agree with the markings of the present species. However, the venation of the wings differs in the two cases: the ulnar of *T. conspersa* is bifurcate, but 4-ramose in *T. picturata*. Further: *T. picturata* has 10 costals, of which the first eight are simple, and the 9th and 10th ramose, whilst *T. conspersa* has 8 or 9 costals (according to Saussure's description), all simple (according to his illustration).

One interesting point has yet to be mentioned: of the eight species of *Theganopteryx*, known from Madagascar, five have spotted tegmina, viz., *T. conspersa*, S., *T. difficilis*, S., *T. punctata*, S., *T. hova*, S. and Z., and *T. molesta*, S. and Z., whilst in three species they are not spotted, viz., *T. bidentata*, S. and Z., *T. malagassa*, S. and Z., and *T. tricolor*, S. and Z. Of the six species recorded from the Seychelles none has spotted tegmina, whilst of those from Rodriguez *T. picturata* has spotted tegmina, but the two other species, described below, have not.

2. *Theganopteryx snelli*, sp. n. (Fig 2.)

♂. Head freely exposed, vertex deep orange, a dull white patch between vertex and antennal sockets, face pale orange;

Fig. 2.



Theganopteryx snelli, sp. n., ♂.

Left wing, $\times 6$.

eyes apart $\frac{1}{2}$ the width of the head; antennæ pale orange-fulvous. Pronotum broad-oval, anterior and posterior

margins almost straight; disk dull orange, its right and left halves enclosed by dark brown lines; lateral margins broad, fulvous. Tegmina exceeding body and cerci, hyaline, with a fulvous hue, except in the anal area; veins delicate, fulvous, cross-venules well marked, producing a reticulate appearance; 11 costals; 7 somewhat oblique discoidal sectors; anal area at its proximal border with a dark brown patch, and with a few brown dots following the anal veins. Wings fuscous, costal border whitish; mediastinal vein bifurcate; radial vein simple, almost straight, 11 costals; median vein distally bifurcate; ulnar 3-ramose; apical triangle well developed, anterior half uniform smoky, posterior half with a whitish patch; first axillary 4-ramose. Abdomen above orange-testaceous, below pale testaceous. Cerci pale testaceous. Subgenital lamina large, hexagonal. Styles short, cylindrical. Legs yellowish testaceous; front femora on the anterior margin with 3 long spines, followed by a series of most minute piliform spines (type B).

♂. Total length 11 mm.; body 8 mm.; pronotum 2×3 mm.; tegmina 9 mm.

Loc. Rodríguez (Thomasset and Snell, viii.-xi. 1918), 1 ♂.

3. *Theganopteryx thomasseti*, sp. n.

♂. Head exposed, orange, vertex darker; eyes apart at least $\frac{1}{3}$ the width of the head; antennæ testaceous. Pronotum suboval, broader behind than in front, posterior border only very slightly produced; disk indistinctly mottled dark and light castaneous; lateral margins broadly hyaline. Tegmina exceeding the abdomen, semi-hyaline testaceous, except the anal area; 10 costals, of which the 9th and 10th are ramose; 8 strongly oblique discoidal sectors; proximal $\frac{1}{3}$ of anal area dark castaneous, the anal veins appearing as broken castaneous lines. Wings with the greater part of the costal area colourless, remainder fuscous; 9 costals, median vein simple, ulnar 3-ramose, apical triangle well marked, first axillary 4-ramose, the first two branches distally anastomosing. Abdomen below pale testaceous. Subgenital lamina large, hexagonal. Cerci pale testaceous. Styles short, cylindrical. Legs orange, anterior femora on the anterior margins with a few large spines, followed by a series of most minute piliform spines (type B).

♂. Total length 10 mm.; body 7.5 mm.; pronotum 2×3 mm.; tegmina 8 mm.

Loc. Rodríguez (Thomasset and Snell, viii.-xi. 1918), 1 ♂.

This species closely resembles the preceding one in general

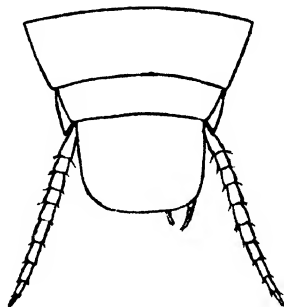
appearance and colouring, but shows certain differences in venation which may be tabulated as follows:—

<i>T. snelli.</i>	<i>T. thomasseti.</i>
Tegmina: 11 costals; 7 discoidal sectors.	Tegmina: 10 costals; 8 discoidal sectors.
Wings: 11 costals; median vein bifurcate; first axillary with the first two branches free.	Wings: 9 costals; median vein simple; first axillary with the first two branches anastomosing.

4. *Margattea sinclairi*, sp. n. (Fig. 3.)

♂. Head exposed, mottled fuscous and ferruginous; eyes apart by at least $\frac{1}{3}$ the width of the head; antennæ (mutilated) ferruginous. Pronotum with the anterior margin parabolic, posterior margin slightly produced; disk mottled dull orange and ferruginous; lateral margins broad, hyaline. Tegmina exceeding body and cerci, uniform pale amber, semi-hyaline; radial bifurcate at $\frac{3}{4}$ its length, its posterior branch ramose; 13 costals; 8 longitudinal discoidal sectors; anal area narrow, elongate, anal sulcus ending

FIG 3



Margattea sinclairi, sp. n., ♂.

End of abdomen from below, $\times 9$.

in the middle of the sutural margin, 6 anals. Wings pale fulvous, middle of the costal margin brownish; mediastinal vein 5-ramose; radial vein bifurcate at $\frac{3}{4}$ its length; 11 costals, the first five stout, dark brown, terminally lighter; posterior branch of radial 3-ramose; median vein simple, only slightly sinuous; ulnar 4-ramose; no apical triangle; first axillary 4-ramose. Abdomen below ferruginous-testaceous; subgenital lamina large, produced, longer than broad, apex rounded. Cerci ferruginous. Styles asymmetrical, shifted to the left, bearing a few fine hairs apically. Legs testaceous, front femora on their anterior margins with

4 stout spines, followed distally by a series of minute piliform spines (type B).

♂. Total length 16 mm.; body 13 mm.; pronotum 3×4 mm.; tegmina 12.5 mm.

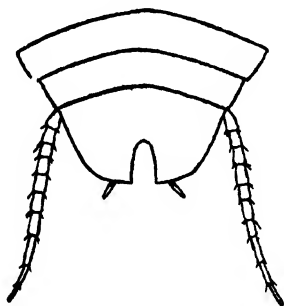
Loc. Rodriguez (*F. Sinclair*, no date), 1 ♂.

The large size of the subgenital lamina, with its asymmetrical styles, will distinguish this from allied species.

5. *Margattea bilobata**, sp. n. (Fig. 4.)

♂. Head exposed, fusco-testaceous; eyes apart $\frac{1}{3}$ the width of the head; (antennæ missing). Pronotum broad, suboval, posterior margin slightly rounded; disk mottled testaceous and fuscous; lateral margins broad, hyaline. Tegmina exceeding the body, reaching to the tip of the cerci, pale testaceous, semi-hyaline; 11 costals, the first eight simple, the ninth, tenth, and eleventh ramose; 7 longitudinal discoidal sectors; anal sulcus ending at $\frac{1}{3}$ of

Fig. 4.



Margattea bilobata, sp. n., ♂.

End of abdomen from below, $\times 9$.

the sutural margin; 5 anals. Wings hyaline, veins delicate and pale, costals with a faint fulvous tinge; mediastinal bifurcate; radial straight, simple; 5 costals, the first three of which are simple, the fourth and fifth ramose; median vein simple; ulnar 5 ramose; apical triangle only slightly developed; first axillary 4-ramose. Abdomen below rufo-testaceous; sub-genital lamina produced, with a broad median cleft, dividing the lamina down to nearly its centre into two sub-triangular lobes, to the outer margins of which the short and stout styles are attached. Cerci long, rufo-testaceous, hirsute. Legs testaceous, strongly armed; front femora on their anterior margin with 2 or 3 long spines, followed by a

* From the two lobes of the sub-genital lamina.

series of piliform spines, extending over more than half the length of the femur (type B).

♂. Total length 13.5 mm.; body 10 mm.; pronotum 2.8×4.5 mm.; tegmina 10 mm.

Loc. Rodriguez (F. Sinclair, no date), 1 ♂.

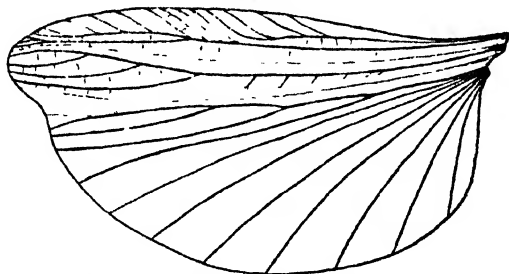
This species is closely allied to *M. longicercata*, Bolivar, from the Seychelles. It differs from it by the fissure of the subgenital lamina of the ♂ being much wider, and by the venation of the wings. The veins of *M. longicercata* are stout and fulvous in colour, those of *M. bilobata* delicate and pale. The ulnar vein of the wing of either species is 5-ramose, but whilst in *M. longicercata* the main branch gives off four branches, in *M. bilobata* the five branches are produced by repeated bifurcation.

Two other allied forms are *M. fissa*, Sauss., from Madagascar, and *M. parvula*, Bol., from the Seychelles, the differences of which from *M. longicercata* are given in Bolivar's paper.

6. *Margattea* (?) *gulliveri*, sp. n. (Figs. 5 & 6.)

♀. Head free, testaceous to light castaneous, a large darker blotch just above the antennal sockets; eyes apart $\frac{1}{3}$ the width of the head; antennæ (mutilated) castaneous, their basal joints testaceous. Pronotum large, anterior

Fig. 5.



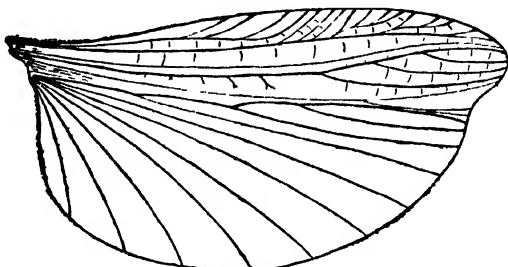
Margattea (P) *gulliveri*, sp. n., ♀.

Left wing, $\times 5$.

margin parabolic, posterior margin slightly produced; disk rufo-castaneous, with a few darker blotches; lateral margins broad, pale fulvous. Tegmina exceeding the abdomen, pale amber, unicolorous; 12 costals, the first nine simple, the 10th and 11th very long, multi-ramose, the 12th simple; 9 longitudinal discoidal sectors; anal area long and narrow, 6 anal veins. Wings hyaline, with the anterior border and the apex fulvous; mediastinal vein very long, reaching to quite $\frac{3}{4}$ the length of the wing, 4-ramose; radial

(left) bifurcate at $\frac{3}{4}$ from its base, anterior branch with 8 simple costals, posterior branch 3-ramose; radial (right) simple, with 6 costals, the 4th and 5th of which are ramose; median vein simple, slightly sinuous; ulnar 4-ramose; 1st axillary 4-ramose; transverse venules strongly developed, some of those arising from the middle of the ulnar vein being especially long and directed forwards, reminding of *Ischnoptera*. Abdomen above and below fuscotestaceous. Supra-anal lamina transverse rhomboidal (in poor condition, shrivelled up). Sub-genital lamina rounded (cerci missing). (Legs missing, with the exception of the right mid-coxa and femur, and the right hind coxa, femur, and tibia.) Posterior femur not armed on the anterior

Fig. 6.

*Margattea* (?) *gulliveri*, sp. n., ♀.Right wing, $\times 5$.

margin, with two large spines towards the end of the posterior margin.

♀. Total length 17 mm.; body 12 mm.; pronotum 3.5×5 mm.; tegmina 14 mm.

Loc. Rodriguez (*G. Gulliver*, Transit of Venus Expedition, 1874-5), 1 ♀.

This species, which Butler recorded under the name of *Phyllodromia germanica*, L., can on account of its large size and light castaneous colour readily be distinguished from the other species of *Margattea* recorded from Rodriguez and the Seychelles. Its generic position must remain uncertain, (1) as the ♂ is unknown, (2) as both fore-legs are missing.

XLV.—Notes on *Aiolopus tergestinus* (Charp.) and its Allies (Orth., Acrididæ). By B. P. UVAROV.

BRUNNER VON WATTENWYL, in his 'Prodromus der Europäischen Orthopteren' (p. 148), pointed out the extraordinary variability of *Aiolopus* (= *Epacromia*) *tergestinus* (Charp.) in size, and Karny (Verh. zool.-bot. Ges. Wien, lvii. 1907,

pp. 284–287) attempted to separate and tabulate what he considered to be various geographical forms of the species. Owing to the kind assistance of Dr. H. Zerny and Prof. R. Ebner I had the opportunity to study the original specimens on which Karny's revision was based, while Dr. Ramme was obliging enough to send me a specimen belonging apparently to the original series in Charpentier's collection; and I feel it necessary to record the results of my examination of the material, as well as to point out certain characters important in the classification of the group, though overlooked by previous authors.

Karny based his exceedingly brief descriptions of various "forms" of *A. tergestinus* almost entirely on colour and on relative dimensions (though no actual measurements were given), and paid scarcely any attention to morphological characters. It is not surprising, therefore, that one of his new "forms" does not belong to the genus *Aiolopus* at all, but is a *Hilethera*, while amongst other "forms" at least three distinct species are represented.

It must be clearly understood that the present paper does not pretend to be even an attempt at a revision of this difficult group of species, though it may help someone towards such a revision, which is badly wanted.

One of the primary taxonomic characters in the group, entirely unnoticed by previous authors, is the degree of development of the pulvilli between the tarsal claws; this structure is obviously of specific value throughout the genus *Aiolopus*, since *A. oxianus*, Uv. ('Eos,' ii. 1926, p. 347), differs in this respect very strikingly from the common *A. thalassinus* (F.).

1. *Aiolopus tergestinus* (Charp.).

1825. *Aiolopus tergestinus*, Charpentier, Horæ Entomol. p. 139.

1853. *Epacromia thalassina*, var. *tergestina*, Fischer, Orth. Europæa, p. 363.

1907. *Aiolopus tergestinus tergestinus*, Karny, l. c. pp. 285, 287.

Dr. Ramme communicated me from the Berlin Museum a specimen which apparently belongs to Charpentier's typical series, while it is certainly one of the types of Fischer's redescription of *tergestinus*. An examination of this specimen shows that Karny's conception of the typical *tergestinus* was correct.

As a species, *A. tergestinus* is characterized by long slender antennæ, the middle joints of which are at least twice as long as broad; by the distinctly saddle-shaped pronotum; by the long and narrow elytra extending beyond the middle of hind tibiæ; and by the minute and very narrow pulvilli between

the tarsal claws. The lower sulcus of the hind femora is brownish or greyish, often pale yellowish, but apparently never red or reddish.

The measurements of the typical *A. tergestinus tergestinus* from Trieste are as follows:—

Length of body, ♂ 21, ♀ 35 mm.; elytra, ♂ 21, ♀ 30 mm.; hind femur, ♂ 12, ♀ 17 mm.

Specimens of *A. tergestinus* from Central Asia are larger than the typical ones, have relatively longer antennæ, and more acute hind pronotal angle; they may, perhaps, be separated subspecifically, but I abstain from doing so without a critical study of extensive series of specimens from various localities.

The form discovered by Karny under the name *viridis* seems to be merely a very striking, uniformly green, colour-variety of the species; it has been described (always under the same name!) by four different authors, as follows:—

1849. *Edipoda pulverulenta*, var. *viridis*, Kittary, Bull. Soc. Imp. Natur. Moscou, xxii. p. 476.

1906. *Epacromia tergestina*, var. *viridis*, Mabille, Ann. Soc. Ent. France, lxxv. p. 41.

1907. *Aiolopus tergestinus*, var. *viridis*, Karny, l. c. p. 285.

1910. *Epacromia viridis*, Uvarov, Horæ Soc. Entom. Ross. xxxix. p. 372.

The above synonymy has been fully established by Ikounikov in 1911 ('Revue Russe d'Entom.' xi. p. 354).

It is curious that var. *viridis* seems to occur only in the female sex, and, according to my experience, always in a small proportion to the typically grey individuals; the males taken together with green females are always grey. Intermediate forms of females, with either grey or green colour predominating, are also known to me. It must be realized, however, that homologous green varieties may exist in other subspecies of *A. tergestinus* or in other species of the genus.

1 a. *Aiolopus tergestinus ponticus*, Karny.

1907. *Aiolopus tergestinus ponticus*, Karny, l. c. pp. 286, 287.

This is clearly only a subspecies of *A. tergestinus*, differing from the typical subspecies in the somewhat smaller size and relatively shorter elytra; the dimensions of a pair of co-types from Siders, Wallis, Switzerland, are as follows:—

Length of body, ♂ 18, ♀ 28 mm.; elytra, ♂ 17, ♀ 26 mm.; hind femur, ♂ 10, ♀ 14 mm.

Karny refers to this subspecies also specimens from Northern Tirol and Sarepta, but I prefer to reserve my opinion on them.

2. *Aiolopus chinensis*, Karny.

1907. *Aiolopus tergestinus chinensis*, Karny, l. c. pp. 285, 287.

This is undoubtedly a good species, differing from *A. tergestinus* by short and stout antennæ, the middle joints of which are less than twice as long as broad; by the pronotum scarcely saddle-shaped; by shorter and broader elytra; and, particularly, by large and broad pulvilli between the tarsal claws. Lower side of the hind femora is practically always more or less reddish, except in very pale green-coloured specimens.

There is, apparently, no great difference in the areas of distribution of *tergestinus* and *chinensis*, both species being known to me, for instance, from Trieste, from Turkestan, etc., though in China and Eastern Siberia only *A. chinensis* seems to occur, which is, of course, not a sufficient reason to regard it as a subspecies of *tergestinus*. The fact that the two species occur actually together accounts for their being confused by previous authors, who failed to notice their striking and constant differences.

A. chinensis, like *A. tergestinus*, gives a number of local subspecies, which could be properly characterized only after a careful study of mass materials from various localities. At present two subspecies are known—the typical one and *A. chinensis pannonicus*, Karny.

A. chinensis chinensis is a rather slender insect, somewhat resembling in its habitus to *A. tergestinus*, the more so that its pronotum is slightly saddle-shaped and elytra relatively long; tarsal pulvilli are, however, entirely different from those in *A. tergestinus*. Measurements of the typical pair (from an unknown locality in China) are as follows:—

Length of body, ♂ 18, ♀ 26 mm.; elytra, ♂ 19·5, ♀ 26 mm.; hind femur, ♂ 11·5, ♀ 14 mm.

Specimens from Central Asia and Western Europe differ somewhat from the typical subspecies by more decidedly roof-shaped pronotum, shorter elytra, and smaller size, but I abstain from describing new subspecies without more extensive studies.

2 a. *Aiolopus chinensis pannonicus*, Karny.

1907. *Aiolopus tergestinus pannonicus*, Karny, l. c. pp. 286, 287.

The local form of *A. chinensis* occurring at the Neusiedlersee in Austria is remarkable for its very small size, decidedly

roof-shaped pronotum, and very short elytra. Its measurements, after a typical pair, are as follows:—

Length of body, ♂ 12, ♀ 19 mm.; elytra, ♂ 10·5, ♀ 16 mm.; hind femur, ♂ 8, ♀ 12 mm.

3. *Ailopus crassus*, Karny.

1907. *Ailopus tergestinus crassus*, Karny, l. c. pp. 286, 287.

1926. *Ailopus crassus*, Uvarov, Eos, ii. p. 346.

I have already redescribed this insect, which represents a species very distinct from *A. tergestinus* or *A. chinensis*.

Ailopus tergestinus maculatus, Karny, does not belong to this genus at all, but is a *Hilethera* synonymous with my *H. buxtoni*, Uv., described in 1922 (see my notes in 'Eos,' ii. 1926, p. 349).

XLVI.—*Synonymy in the Genus Kerria* [*Oligochæta*, Onceroдрilinae]. By GRACE E. PICKFORD.

(From the Department of Zoology, University of Witwatersrand,
Johannesburg.)

Kerria saltensis, Bedd.

1895. *Kerria saltensis*, Beddard, Proc. Zool. Soc. Lond. p. 225.

1896. *Kerria saltensis*, Beddard, Ergeb. Hamb. Magalh. Sammlr.
Naid. Tubif. Terricol. p. 46.

1898. *Kerria saltensis*, Michaelsen, Zool. Jahrb., Suppl. 41, p. 479.

1900. *Kerria saltensis*, Michaelsen, Tierreich, Oligochæta, l. 10, p. 371.

1903. *Acanthodrilus sydneyensis* (Fletcher Mus. name), G. Sweet,
Journ. Linn. Soc., Zool. vol. xviii. p. 124, pl. xiv. fig. 7, pl. xv.
fig. 18 a-c.

1907. *Kerria saltensis*, Michaelsen, Abh. naturw. Ver. Hamburg,
xix. Bd. 1 Hft. p. 23.

1912. *Kerria gunningi*, Michaelsen, Zoologica, Hft. 68, p. 1.

1913. *Kerria gunningi*, Michaelsen, Ann. Natal Mus. vol. ii. pt. R,
p. 419; Sarasin & Roux, Nova Caledonia Zool. vol. i. l. iii.
no. 5, p. 276.

Material examined.—

- (1) *Kerria saltensis*, Bedd. Co-type? Examined for me by
Dr. Monro at the British Museum.
- (2) *Kerria saltensis*, Bedd. Co-type. Salto, Valparaiso,
semi-mature specimen.

- (3) *Kerria saltensis*, Bedd. Parramatta, New South Wales, 31. x. 05, Mich. leg., one semi-mature specimen and an anterior end.
- (4) *Acanthodrilus sydneyensis*, Fletcher. Co-types. Sydney, one clitellate and two semi-mature specimens.
- (5) *Kerria gunningi*, Mich. Co-types. Zoological Gardens, Aapies R., Pretoria, 30. viii. 11, Mich. leg., three clitellate, four non-clitellate specimens, and fragments.
- (6) *Kerria gunningi*, Mich. Stellenbosch Flats, W. Cape Province, 19. xii. 25, coll. G. E. P. nr. Lyndhurst, Johannesburg, two; and 10. x. 26, coll. G. E. P., numerous mature and immature specimens.

Spermathecal pores inconspicuous or on small papillæ below the setal line *c*, usually about one-third the distance *bc* from *c*. Clitellum saddle-shaped or ring-shaped, more or less incomplete ventrally. Spermathecal duct as long as or somewhat longer than the ampulla and nearly as broad, but narrowing to form a neck before it enters the ampulla; total length of spermatheca 0.5–0.8 mm. (figs. 1–4).

Prostatic glands very long and thin, somewhat coiled, passing backwards through several segments (ca. 7) close to the nerve-cord and hidden beneath the gut. Prostatic ducts confined to one segment, somewhat curved and passing transversely out at right angles to the gland. It would seem that Michaelsen mistook the prostatic ducts for the whole gland in his description of *K. gunningi*, as the prostates are present typically for *K. saltensis* in the co-types lent me for examination; nor does *K. gunningi* differ essentially in any other way, the observed differences discussed by Michaelsen being probably due to different degrees of maturity and states of preservation.

Distribution.—The distribution of *K. saltensis* is typically peregrine, as it occurs sporadically all over the Southern Hemisphere. In origin it is undoubtedly S. American, and its distribution cannot legitimately be adduced as evidence in support of Wegener's Theory of Continental Drift.

S. America: Chile (Salto near Valparaiso, Quillota, Coquimbo, ? Valparaiso); Juan Fernandez Is.

S. Africa: Cape (Stellenbosch); Natal (Durban, Howick); Transvaal (Pretoria, Johannesburg).

Australia: New South Wales (Sydney, Paramatta, Mt. Victoria).

New Caledonia: Oubatche.

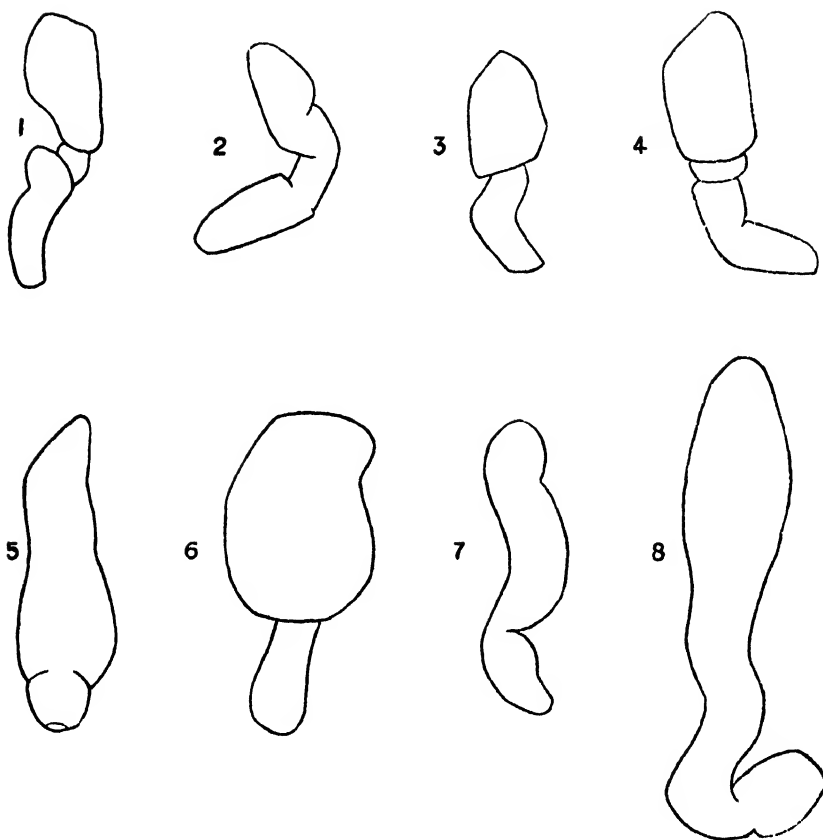


Fig. 1.—*Kerria saltensis*, Bedd. Paramatta, New South Wales. Spermatheca, $\times 50$.

Fig. 2.—Ditto [*Ac. sydneyensis*, Fletcher, co-type]. Sydney, New South Wales. Spermatheca, $\times 50$.

Fig. 3.—Ditto, co-type. Salto, Valparaiso, Chile. Spermatheca, $\times 50$.

Fig. 4.—Ditto [*K. gunningi*, Mich.]. Johannesburg, Transvaal. Spermatheca, $\times 50$.

Fig. 5.—*Kerria rosæ*, Bedd., co-type. Buenos Ayres, Argentine. Spermatheca, $\times 50$.

Fig. 6.—*Kerria* sp. from co-types of *K. rosæ*. Buenos Ayres, Argentine. Spermatheca, $\times 50$.

Fig. 7.—*Kerria subandina*, Rosa, co-type. Salta, Argentine. Spermatheca, $\times 50$.

Fig. 8.—*Kerria borellii*, Cognetti, co-type. Urucum, Matto Grosso, Brazil. Spermatheca, $\times 50$.

Kerria subandina, Rosa.

1895. *Kerria subandina*, Rosa, Bull. Mus. Torino, v. 10, nr. 204; id. Mem. Ac. Torino, nr. 2, v. 45.

1900. *Kerria subandina* (pt.), Michaelsen, Tierreich, Oligochæta, l. 10.

Material examined.—Co-types from Salta, Argentine, two semi-mature specimens and fragments. Turin Museum.

Spermathecal pores very inconspicuous, about one-third *bc* below setal line *c*, not midway between *b* and *c* as described by Rosa. Spermathecal duct about half the length of ampulla (fig. 7). Prostatic duct thinner proportionately to gland than in *K. borellii*. Total length of spermatheca 0.72 mm.; cf. *K. borellii*.

Kerria borellii, Cognetti.

1900. *Kerria borellii*, Cognetti, Bull. Mus. Torino, v. 15.

1900. *Kerria subandina* (pt.), Michaelsen, Tierreich, Oligochæta, l. 10.

Material examined.—Co-types from Utiucum, Matto Grosso, Brazil, two semi-mature specimens and fragments. Turin Museum.

Spermathecal pores on conspicuous papillæ just below the setal line *c*, not midway between *c* and *b* as described by Cognetti. Spermathecal ampulla elongate tear-bottle-shaped, the duct less than one-fourth length of ampulla; total length ca. 1.8 mm. (fig. 8).

This species is very close to *K. rosæ* and *K. subandina*; it differs from the former, if at all, chiefly by its larger size and more prominent spermathecal pores. From *K. subandina* it differs in the relatively shorter length of the spermathecal duct and the conspicuous spermathecal papillæ.

Kerria rosæ, Bedd.

1895. *Kerria rosæ*, Beddard, Proc. Zool. Soc. Lond. p. 224.

1896. *Kerria rosæ*, Beddard, Ergeb. Hamb. Magalh. Sammelr. Naid. Tubif. Terricol. p. 41.

1900. *Kerria rosæ*, Michaelsen, Tierreich, Oligochæta, l. 10.

Material examined.—

(1) *Kerria rosæ*. Co-type? Buenos Ayres, 10. v. 04, one semi-mature specimen. British Museum.

(2) *Kerria rosæ*. Co-types. Barracas del Sur, Buenos Ayres, two juvenile specimens. Hamburg Museum.

Spermathecal pores inconspicuous or on small papillæ about one-third *bc* below the setal line *c*. Spermathecal duct

very short, ampulla long and finger-shaped, thicker proximal to the duct. Length 0.75 mm.

One of the three specimens sent me by Michaelsen has a peculiar spermatheca in which the ampulla is oval, very swollen, and only a little longer than the duct (fig. 6), while the spermathecal pores are on conspicuous papillæ. It cannot be referred to any known species, and is not in sufficiently good state of preservation to justify a new description.

Until new material is forthcoming the status of *K. rosæ*, *K. borellii*, and *K. subandina* cannot be definitely settled, as in all cases the types are in a very unsatisfactory state of preservation. It seems probable, however, that these three species should be regarded as distinct.

The following key is proposed as a modification to be inserted appropriately in Michaelsen's key to the genus *Kerria* in 'Das Tierreich,' p. 369; the key given there is based on erroneous descriptions of the position of the spermathecal pores in *K. borellii* and *K. subandina*, and these two species are there synonymized:—

- | | |
|---|--------------------------------|
| 7. Spermathecæ spirally twisted | <i>K. garmani</i> , Rosa. |
| Spermathecæ not spirally twisted | 8. |
| 8. Spermathecal duct about as long as or longer than ampulla | <i>K. saltensis</i> , Bedd. |
| Spermathecal duct much shorter than ampulla | 9 a. |
| 9 a. Spermathecal duct $\frac{1}{4}$ or less than $\frac{1}{4}$ length of ampulla. Spermathecal pores on more or less conspicuous papillæ | 9 b. |
| Spermathecal duct about $\frac{1}{2}$ or $\frac{3}{4}$ length of ampulla. Spermathecal pores very inconspicuous | <i>K. subandina</i> , Rosa. |
| 9 b. Size 60-80 mm. | <i>K. borellii</i> , Cognetti. |
| Size circa 25 mm. | <i>K. rosæ</i> , Bedd. |

My best thanks are due to Dr. Monro of the British Museum, who examined the single specimen of *K. rosæ* for me and lent me a co-type of *K. saltensis*; to Dr. Rondelli of the Turin Museum, who lent me the types of *K. subandina* and *K. borellii*; and especially to Dr. Michaelsen of the Hamburg Museum, who gave me co-types of *K. rosæ*, *K. saltensis*, and *Ac. sydneyensis*, as well as specimens of *K. saltensis* from other localities, and who lent me the co-types of *K. gunningi*.

XLVII.—*A new Species of Lizard from Argentina.*

By H. W. PARKER, B.A.

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PERACCA * has recorded, under the name *Amphisbæna darwini*, Dum. & Bibr., a lizard from Tucuman which differed from other specimens of this species in having more numerous segments in an annulus at mid-body—viz., 56 instead of 28–40; the number of annuli on the body is given as 208. In pointing out this difference Peracca suggests the possibilities that the specimen may represent a distinct species intermediate in its characters between *A. darwini* and *A. camura*, Cope, or that these two species may grade into one another. Koslowsky † refers what appear to have been three similar specimens from Catamarca and Salta (annuli 180–220 and segments 50 at mid-body) to *A. plumbea*, Gray, but offers no explanation of the very low number of annuli compared with that species (270). The British Museum now possesses five specimens which, like the above-mentioned examples, differ from *A. darwini* in a higher number of segments in an annulus and from *A. plumbea* in a lower number of annuli. Comparison of these five specimens with the type of *A. plumbea* and with a series of specimens of *A. darwini* (29) and *A. camura* (6) appears to show that they belong to a distinct species for which the name proposed is

Amphisbæna knighti, sp. n.

Amphisbæna darwini (part.), Peracca, Boll. Mus. Torino, x. 1895, no. 195, p. 9.

Amphisbæna plumbea (non Gray), Koslowsky, Rev. Mus. La Plata, viii. 1898, p. 187.

Type-specimen a female, number 1928.5.2.1 in the British Museum, collected at Bonifacio, Argentina (approx. 36° 49' S. by 62° 18' W.), by Colonel Morley Knight, to whom the author is indebted for several collections from this locality.

Præmaxillary teeth 7; maxillaries 5–5; mandibulars 8–8. Snout rounded, prominent. Tail cylindrical, as thick as the body. Rostral subtriangular, just visible from above; nasals large, forming a median suture $\frac{2}{3}$ the length of the suture between the single pair of large præfrontals; frontals smaller than the præfrontals, much longer than broad, truncate posteriorly and followed by a pair of small occipitals,

* Boll. Mus. Torino, x. 1895, no. 195, p. 9.

† Rev. Mus. La Plata, viii. 1898, p. 187.

together with which they form an almost circular figure; ocular in contact with the second and third labials, followed by a postocular; upper labials four, the last minute; three lower labials; a median and two pairs of chin-shields, the median in contact with the mental and first and second lower labials, the first pair just touching the second labial and the second pair in contact with the second and third labials. 203 annuli on the body and 17 on the tail; segments of the annuli longer than broad dorsally and laterally, but broader than long on the middle of the belly; 52 segments in an annulus at the middle of the body, 24 above the distinct lateral lines, and 28 below; anal segments 6; preanal pores 4.

Colour in spirit.—Grey-brown above, lighter beneath.

Total length 295 mm.; tail 28; diameter of body 12.

Paratypes.—1927. 5. 26. 4. ♀, Bonifacio. No occipitals. Annuli 215 + 18. Segments $\frac{22}{28}$. Total length 334 mm.

1909. 11. 2. 8. ♂, Ajo, Prov. Buenos Ayres. Annuli 203 + 17. Segments $\frac{21}{26}$. Total length 320 mm.

1909. 11. 2. 9. ♀, Ajo, Prov. Buenos Ayres. No occipitals. Annuli 205 + 18. Segments $\frac{23}{28}$. Total length 311 mm.

1902. 7. 29. 65. ♂, Tucuman. No occipitals. Annuli 204 + 18. Segments $\frac{21}{24}$. Total length 244 mm.

This new species appears to have a wide distribution in western and southern Argentina and to be closely allied to *A. darwini* and *A. plumbea*, the species with which it has previously been confounded. It may be distinguished from these two species as follows:—

I. Usually only 3 upper labials; suture between the nasals less than half that between the præfrontals.

Frontals much longer than broad, narrowed posteriorly; annuli on body 177–214; segments in an annulus at mid-body 28–40 . .

[Bibr.
A. darwini, Dum. &

II. Usually 4 upper labials, the last small; suture between the nasals about $\frac{2}{3}$ that between the præfrontals.

(a) Frontals much longer than broad, truncate posteriorly; annuli on body 180–220; segments in an annulus at mid-body 45–56.

A. knighti, sp. n.

(b) Frontals as broad as long; annuli on body 270*; segments in an annulus at mid-body 46

A. plumbea; Gray.

* Boulenger (Cat. Lizards B.M. ii. p. 444) has pointed out that the number of annuli is no longer controllable on the type-specimen, but that Gray's figure (270) is probably correct; 257 annuli can still be counted, and the space at the middle of the body over which they cannot be counted corresponds in length to about 10–12 segments.

XLVIII.—*A new Siluroid Fish of the Genus Chrysichthys from Nigeria.* By J. R. NORMAN.

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Chrysichthys macropogon, sp. n.

Depth of body $4\frac{1}{6}$ in the length, length of head 3. Head $1\frac{1}{3}$ times as long as broad, upper surface of postorbital part somewhat rugose; occipital process rather narrow, in contact with interneural shield; snout broadly rounded, $1\frac{1}{2}$ times as broad as long; diameter of eye $6\frac{1}{3}$ in length of head, $2\frac{1}{3}$ in length of snout, and $2\frac{1}{4}$ in interorbital width; mouth sub-inferior, its width $1\frac{3}{8}$ in length of head; præmaxillary band of teeth slightly curved, length of band more than $\frac{1}{2}$ width of head; vomero-ptyergoid teeth forming a narrow band, narrowly interrupted in the middle; nasal barbel $1\frac{3}{4}$ times diameter of eye; maxillary barbel $1\frac{1}{4}$ times length of head, reaching beyond tip of pectoral spine when laid back; outer mandibular barbel longer than inner, nearly $\frac{2}{3}$ length of head. Gill-rakers of moderate length, 17 on lower part of anterior arch. Dorsal I 6; about equidistant from end of snout and base of caudal; spine strong, upper part feebly serrated in front and behind, nearly $\frac{3}{8}$ length of head; longest soft rays much shorter than head, not produced, not nearly reaching adipose fin when laid back. Base of adipose fin nearly equal to that of rayed dorsal, $1\frac{1}{3}$ in its distance from latter. Anal 12 or 13; 8 rays branched. Pectoral about $\frac{2}{3}$ length of head, spine feebly granulated or serrated on outer border, strongly serrated on inner. Caudal forked, upper lobe longer. Caudal peduncle a little longer than deep. Greyish brown above, silvery white below; an ill-defined blackish blotch on the shoulder immediately behind the gill-opening; a broad dusky longitudinal band on each lobe of the caudal fin; other fins greyish or whitish.

A single specimen, 185 mm. in total length, from the Kiyawa River (near Katagum), Northern Provinces, Nigeria; collected and presented to the British Museum by Mr. Ll. Lloyd.

Perhaps related to *Chrysichthys punctatus*, Boulenger, from the Upper Congo.

XLIX.—On a *Trichogrammid* (*Doirania leefmansii*, gen. et sp. n.) reared from Eggs of *Sexava* (Orth.) in the Dutch East Indies. By Dr. JAMES WATERSTON.

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CHALCIDOIDEA.

Family Trichogrammidæ.

DOIRANIA, gen. nov.

Head: eyes minutely and sparsely pilose; antennæ five-jointed; scape, pedicel, ring-joint, one in funicle, and solid club.

Mandibles broad, apically tridentate.

Wings: fore wings neuration not forming a regular arch from the junction of submarginal and marginal veins; both veins straight and long; radius short; disc of fore wing with regular rows of minute bristles; fringing cilia moderately long, but not equal to half the width of the wing. Cilia of hind wings as long as those of fore wings.

Legs: hind coxæ large; mesonotum with impressed median line.

Abdomen: both tergite and sternite of the first (third) segment characteristically "ribbed" longitudinally on posterior half—i. e., the chitin thick and thin alternately.

Body with few bristles (noted below in the specific diagnosis, but probably of generic value).

Genotype the following species:—

Doirania leefmansii, sp. n.

Head: from in front very broad (4:3); eyes with minute bristles between the facets, separated at level of anterior ocellus by four- and on base-line by three-fifths of the width; clypeus, two bristles, edge subconvex medianly, shallowly notched. On gena and on area between the torulus and lower angle of eye four or five minute bristles; on face (above the toruli) four bristles on each side remote from the orbits; one longer bristle on the orbit above the eye; one (minute) on each side just behind the anterior ocellus, and a pair (longer) behind the posterior ocelli; on vertex (above and

behind the upper orbital bristle) one bristle at each side; one minute bristle on occiput, at each side, behind the upper corner of the eye.

Antenna length .22 mm. Scape (3:1) about one-fifth longer than pedicel (2:1) or three-fourths as long as funicle plus club, pedicel and club (8:5) subequal in length. Ring-joint minute. Funicular joint half the length of club,* the latter, hardly wider than the funicular and about one-fifth wider than pedicel, bears four or five large sensoria. Mandible (7:5) with three short apical teeth and the cutting-edge angulate behind the apex. Max. palp. papilla-like, hardly longer than broad, with two unequal stout apical bristles.

Thorax: pronotum faintly coriaceous, pattern large, in two sclerites, each with five bristles—one spiracular, one at inner (median) posterior angle, one on disc before the spiracles, and two on anterior edge.

Mesonotum: the impressed line wider on scutellum, surface practically smooth, the pattern, where discernible, finely and faintly striate longitudinally. Mesoscutum two bristles, axilla one, scutellum two. Mesopleura about half longer than scutum and scutellum.

Mesopleura and sternum smooth and bare.

Wings: fore wings about .52 mm. long, nearly three times as long as broad; longest cilia about one-third the width. Submarginal one stout bristle. The vein five-sixths as long as the marginal, which bears six bristles; one on radius; about six rows of cilia (both above and below) on apical two-fifths of wing.

Hind wings only slightly shorter than fore wings, about twelve times as long as broad. Marginal cilia about as long as in fore wing. One longitudinal row of bristles (nearer to the costa than to half), with a few minute bristles between the costa and the major row.

Legs: fore and mid legs about .5 mm., hind legs about one-third longer.

Fore legs: coxa (9:5) outer aspect, one bristle above trochanter, one (long) about middle, with another (minute) in front; posterior aspect one bristle. Femur (10:3) one-sixth longer than tibia (5:1), or one-third longer than tarsus, whose joints are in ratio 12:13:15.

Mid-leg: coxa four bristles. Femur (10:3) three-fourths as long as tibia (7:1) or subequal to tarsus, 16:18:16.

Hind legs: coxa (2:1), large (longer than mid-femur), subequal to femur (3:1); three-fourths the tibia (7:1) or subequal to tarsus, 20:22:18.

Propodeon consisting of a rather narrow median band and two quadrate lateral areas. Spiracle small, circular, about one and a half diameters from anterior edge. Sulcus shallow, with only the inner edge indicated. Two bristles between spiracle and anterior edge and one behind, followed by a minute pustule. Metapleuræ triangular, smooth, bare. Abdomen, tergites subequal, ribbon-like, t. i. (iii.) posteriorly ribbed, with a few large raised cells (mammillated) at sides; t. ii.-vi. simple, smooth; t. i.-iii. with bristles, 1, 1 (at sides), iv.-v. 2, 2, vi. 3, 3; t. vii. bristles 6, 6. Sternites i.-iv. divided with two median bristles, except on st. i.; st. v. in three lobes, the median one trapezoidal, with bristles 1, 2, 1. The first sternite (like the corresponding tergite) posteriorly ribbed, and with a strong keel-like thickening on each side before the edge. Ovipositor (concealed) subequal to antenna.

Length about .8 mm.; expanse about 1.2 mm.

Holotype, ♀, in the British Museum (whole mount in balsam).

Paratype, ♀ (dissected and mounted), from a small series bred from eggs of *Sexava coriacea*, Ambon (D.E.I.), 30. iv. 1925 (S. Leefmans coll.).

I have not seen the ♂.

L. — *Description of a new Cingalese Species of Celama (Heterocera, Subfamily Noliniæ).* By A. E. WILEMAN, F.E.S., and R. J. WEST.

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Celama analis, sp. n.

Male.—Antenna stalked-bifasciculate, the very short stems of the fascicles extending from the antenna shaft plumed at the apex with delicate cilia, *ex* male holotype "Ceylon (*E. E. Green*)," Brit. Mus. Coll. (under microscope).

Female.—Antenna very minutely ciliate with paired minute setæ, *ex* female allotype "Pundaluoya, Ceylon (*E. E. Green*)," Brit. Mus. Coll. (under microscope).

Description.—*Male*. Palpus white, tinged with wood-brown on second segment outwardly. Antenna stalked-fasciculate,

shaft white on basal quarter. Head: frons and vertex white. Thorax white, patagium white, with a faint tinge of wood-brown posteriorly, tegula white. Abdomen light buff above and beneath. Pectus white. Legs: fore and mid legs, coxæ, femora, and tibiæ white speckled with fuscous, tarsal segments fuscous, white at joints; hind leg cartridge-buff, tarsal segments with some fuscous above. *Fore wing* white, with a patch of wood-brown on costa at base, two patches of wood-brown irrorated with fuscous-black on costa, one antemedially, the other medially; antemedial fascia a broken fuscous-black line, oblique to near vein 2, outwardly angled, and oblique to inner margin; postmedial and subterminal fasciæ are two broken fuscous lines, excurved to vein 2, where they are angled inwardly, and again excurved to inner margin; terminal line light buff. *Hind wing* light buff, on the inner margin near tornus with a notch, from which projects a tuft of fuscous hair-scales. *Underside*: fore wing cartridge-buff lightly tinged with fuscous, fuscous on basal half of costa; hind wing light buff.

Expanse 19 mm. (tip to tip 18 mm.).

Female. Differs from male as follows:—Antenna minutely ciliated, with paired setæ, pattern more strongly marked; hind wing white tinged with fuscous on termen, and with no tuft on inner margin near tornus.

Expanse 20 mm. (tip to tip 19 mm.).

Holotype (♂). Ceylon (*E. E. Green*).

Allotype (♀). Pundaluoya, Ceylon
(*E. E. Green*).

Paratypes (2 ♂♂, 2 ♀♀). Ceylon
(*E. E. Green*).

Paratype (♂). Bhutan, India (*F. M.*
Mackwood).

All in the Col-
lection of the
British Museum
(Natural His-
tory).

The above examples of *Celama analis* have hitherto been regarded as belonging to *Celama* (*Pisara*) *internella*, Walker, and have been placed in the British Museum series of *C. internella* together with *C. (Ræselia) pascua*, Swinhoe. *Celama pascua* is differentiated from *C. analis* by the following distinguishing characters:—fore wing narrower, hind wing white; male with a fold on inner margin of under side of hind wing, which contains rough scales (as in Section *Epizeuctis*) instead of a notch from which there projects a tuft of fuscous hair-scales as in *C. analis*.

The diagnosis of the male hind wing and antenna of

the two species *C. analis* and *C. pascua* may be stated as follows :—

Celama analis.

Antenna of male. Stalked-bifasciculate.

Hind wing of male with a fold on inner margin above, containing a tuft, or pencil, of long fuscous hair-scales and some shorter fuscous hair-scales, below, at anal angle-notch.

Celama pascua.

Antenna of male. Stalked-bifasciculate.

Hind wing of male with a patch of rough scales on underside at tornus.

(Cf. Hampson, Cat. Lep. Phal. ii. p. 13, 1900.)

LI.—*The Cirripede Chelonibia caretta, Spengler, in the Miocene of Zanzibar Protectorate.* By THOMAS H. WITHERS, F.G.S.

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AMONG the extensive series of Invertebrate fossils collected by Mr. G. M. Stockley in Pemba Island (1927, Palæont. Zanzibar Protectorate, Government Report) the Cirripedia are represented by but a single specimen. This, however, is quite interesting, for it belongs to the genus *Chelonibia*, which comprises barnacles found living in tropical and temperate seas on turtles, manatees, and crabs. Such barnacles are rare as fossils, and, except for the species *C. hemispharica*, Rothpletz & Simonelli (1891, Zeitsch. deutsch. geol. Ges. xlii. p. 724, pl. xxxvi. fig. 2), founded on a single carino-lateral or lateral compartment from the Pliocene of Grand Canary, the remaining forms occur in Italy and Sicily. These are *C. depressa*, Seguenza (1876, Atti Accad. Pontaniana, x. p. 411), from the Pliocene (Astian) of Sicily, and *C. capellini*, De Alessandri (1906, Palæontogr. ital. xii. p. 313, pl. xviii. figs. 3-5), from the Miocene (Helvetian) and Pliocene (Astian) of Italy. The Recent *C. testudinaria* (Linnæus) has also been recorded from the Pliocene of Italy. Except for the Grand Canary record, therefore, this fossil from Zanzibar is the only *Chelonibia* recorded outside Europe. De Alessandri (1922, Act. Soc. Linn. Bordeaux, lxxiv. p. 223, pl. i. figs. 13-18) has described as *Chelonibia duvergieri*

certain barnacles from the Miocene of Bordeaux, but these do not belong to that genus, but are barnacles resembling *Balanus*.

The Zanzibar fossil is a shell without the opercular valves, and, so far as one can judge from the external characters, does not differ materially from the Recent species *C. caretta* (Spengler), which has not hitherto been found as a fossil. The other fossil species of *Chelonibia* are allied to the Recent *C. testudinaria* (Linnæus).

In *Chelonibia* the orifice is enlarged by the wearing away of the summits of the compartments, and in the Recent *C. caretta* the compartments are often asymmetrically placed, the rostrum and carina not being in exact apposition. The shell is formed of six compartments, and the so-called rostrum is a composite plate formed by the fusion of the true rostrum with the rostro-laterals. In Recent specimens of *C. caretta* the two sutures on the so-called rostrum, denoting the incomplete fusion of the rostrum with the rostro-laterals, can usually be seen in old worn specimens, especially in the upper part of the shell.

Though the asymmetry of the shell is well shown in the Zanzibar fossil, the summits of the compartments are little worn. The so-called rostrum, however, is divided for its whole length by two sutures which are quite deep near the apex—much deeper than in Recent specimens,—and the middle element has slightly developed shoulders or alæ, over which the adjacent rostro-laterals overlap (see text-figure). It is clear that this middle element is the true rostrum—a point already indicated by me (Withers, 1928, Brit. Mus. Cat. Foss. Cirripedia, i. p. 46).

Genus CHELONIBIA, Leach, 1817.

Chelonibia caretta (Spengler).

1790. *Lepas caretta*, Spengler, Skr. Naturh. Selsk. Kjøb. i. p. 185, pl. vi. fig. 4.
 1854. *Chelonibia caretta* (Spengler), Darwin, Ray Soc. Monogr. Balanidae, p. 394, pl. xiv. fig. 2.
 1916. *Chelonibia caretta* (Spengler), Pilsbry, Bull. U.S. Nat. Mus. xciii. p. 267, pl. lxiii. figs. 5, 5a.
 1928. *Chelonibia caretta* (Spengler), Withers, Brit. Mus. Cat. Foss. Cirrip. i. p. 46.

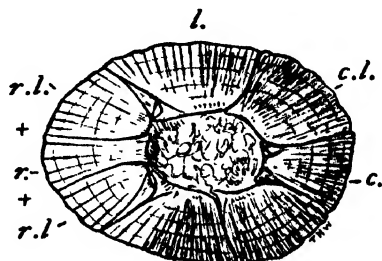
Diagnosis.—A *Chelonibia* with heavy walls, the compartments strong and massive, radii narrow or not developed, parietes solidly filled up nearly to the base, the septa much interrupted. Surface usually ribbed near the periphery.

Distribution.—(Recent). On turtles. Northern Australia ; Torres Strait, Queensland ; Saigon, Cochin China ; East Indies ; Massaua, Eritrea, East Africa ; West Coast of Africa ; Cape of Good Hope ; St. Thomas, West Indies ; Cape Feio, Brazil ; Venezuela ; Delaware Bay, New Jersey.

(Fossil). Lower Miocene (probably Upper Aquitanian), Chake Chake Beds ; no. P. 68, Ras Kingoje, Pemba Island, Zanzibar Protectorate.

Material.—A single complete shell in the Geological Department of the British Museum, registered In. 26663, presented by the Colonial Office, Nov. 1926.

Description.—Shell complete (rostro-carinal length 35·8 mm. ; breadth 28·4 mm. ; height (at rostral end) 14·1 mm.,



Chelonibia caretta (Spengler). Shell, nat. size.

c., carina ; c.l., carino-lateral ; l., lateral ; r., rostrum ;
r.l., rostro-lateral.

lacking the opercular valves, the outer surface of the compartments longitudinally ridged, especially near the periphery. The coarse gritty matrix is full of quartz-grains, which have been forced into the substance of the shell. All, therefore, that can be seen of the inside of the shell is the radiating septa and parts of the lower edge of the sheath. The former form a wide, flat, calcareous surface from the periphery to the lower edge of the sheath, and have their basal edges finely denticulated, consisting of close and rather irregular depending points.

Remarks.—Except that the rostrum and rostro-laterals are less completely fused, the fossil does not differ from any ordinary specimen of the Recent *C. caretta*. It may be, however, that, if the inner surface of the sheath and compartments could be examined and we had the opercular valves, other differences would be apparent.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 11. NOVEMBER 1928.

LII.—*Revision of the African Species of Chætocnema* (Col., Halticidæ). By G. E. BRYANT, Entomological Assistant, Imperial Bureau of Entomology.

THIS genus contains at present about 230 described species ; they are widely distributed throughout the world, representatives occurring from Siberia to South Africa, from India to the Australian region, and in North and South America. There is no doubt that they will all prove to be of great economic importance, as the few records we have of their habits prove that 15 species are known to attack various important crops. There are 26 described African species, to which I now add 9 new species. Two of Jacoby's species will have to be sunk as synonyms—*C. wollantoni*, Baly (= *C. dunbrodensis*, Jac.), and *C. subaterrima*, Jac. (= *C. barkeri*, Jac.).

The genus may be distinguished by the fact that the intermediate and posterior tibiæ are furnished with a tooth on their outer side, between the middle and apex, or, more accurately, are emarginate on their outer side before the apex, both extremities of the emargination being raised into a tooth.

The attempt to make a key to the African species has proved extremely difficult, owing to their strong superficial resemblance, but I give it for what it is worth.

I append a list of the species known to be of economic importance:—

- Chatocnema apricaria*, Suff. Jamaica, Porto Rico. Sweet potato, tomato.
 — *amazona*, Baly. Barbados. Sweet potato.
 — *avidula*, Gyll. France, Russia. Oats and other grain crops.
 — *basalis*, Baly. India. Rice.
 — *breviuscula*, Feld. Russia. Cereals.
 — *concinna*, Chev. Russia, Sweden, etc. Hops, rhubarb, mangel-wurzel.
 — *concinripennis*, Baly. India. Boring stems of seedling paddy.
 — *confinis*, Lec. Virginia, U.S.A. Maize.
 — *denticulata*, Illig. Virginia, U.S.A. Maize.
 — *ectypa*, Horn. U.S.A. Sudan grass, desert corn.
 — *hortensis*, Geoff. Russia. Hemp, cereals.
 — *pulicaria*, Melsh. Virginia, U.S.A. Maize.
 — *pusaensis*, Maulik. India. Boring stems of millet (*Panicum miliaceum*).
 — *tibialis*, Illig. France. Beet.
 — *zæa*, Bryant. Sierra Leone. Maize.

List of African Species.

- Chatocnema abyssinica*, Jac., Ann. Soc. Ent. Fr. lxxvii. 1907, p. 519. Abyssinia.
 — *acutangula*, Wse., Kilim. Mer. Exp. vii. p. 222. Kilimanjaro.
 — *antennata*, Jac., Proc. Zool. Soc. Lond. 1897, p. 561. Mashonaland.
 — *bevinii*, sp. n. Table Mt., Cape Colony.
 — *bilunulata*, Demaison, Bull. Soc. Ent. Fr. 1902, p. 24. Egypt.
 — *capensis*, sp. n. Cape Colony.
 — *chalcona*, Har., Col. Hefte, xiii. 1875, p. 89. S. Africa.
 — *compressipes*, Baly, Trans. Ent. Soc. Lond. 1876, p. 597. Cameroons.
 — *congoana*, nom. nov.
 C. carinata, Jac., Proc. Zool. Soc. Lond. 1899, p. 352 (nec *carinata*, Baly, Tr. Ent. Soc. Lond. 1877, p. 174). Congo.
 — *convexicollis*, Boh., Res. Eugen. 1858, p. 199. Cape Colony.
 — *cristata*, Har., Col. Hefte, xvi. 1879, p. 231. Zanzibar.
 — *darwini*, sp. n. Cape Colony.
 — *frederici*, Jac., Proc. Zool. Soc. Lond. 1899, p. 351. Natal.
 — *gahani*, Jac., Proc. Zool. Soc. Lond. 1897, p. 560. Mashonaland.
 — *kibonotensis*, Wse., Kilim. Mer. Exp. vii. p. 222. Kilimanjaro.
 — *longicornis*, Jac., Trans. Ent. Soc. Lond. 1895, p. 325. Natal.
 — *malvernensis*, sp. n. Natal.
 — *marshalli*, Jac., Proc. Zool. Soc. Lond. 1899, p. 351. Natal.
 — *mashonana*, Jac., Proc. Zool. Soc. Lond. 1897, p. 563. Mashonaland.
 — *metallica*, Bryant, Ann. & Mag. Nat. Hist. xvii. 1926, p. 407. Sierra Leone.
 — *montana*, sp. n. Cape Colony.
 — *natalensis*, Baly, Trans. Ent. Soc. Lond. 1877, p. 166. Natal.
 — *njalensis*, sp. n. Sierra Leone.
 — *pulla*, Chap., Ann. Mus. Civ. Gen. xv. p. 14. Abyssinia.
 — *purpurea*, Jac., Trans. Ent. Soc. Lond. 1906, p. 19. Cape Colony.
 — *semiregulata*, Jac., Proc. Zool. Soc. Lond. 1897, p. 562. Mashonaland.

- Chætocnema sierræleonis*, sp. n. Sierra Leone.
 — *subaterrima*, Jac., Proc. Zool. Soc. Lond. 1900, p. 254. Natal.
C. barkeri, Jac., Trans. Ent. Soc. Lond. 1906, p. 18. Natal.
 — *subquadrata*, Jac., Proc. Zool. Soc. Lond. 1897, p. 561. Mashonaland.
 — *tablensis*, sp. n. Table Mt., Cape Colony.
 — *turneri*, sp. n. Zululand.
 — *vincenti*, Reitt., Wein. Ent. Zeit. xxv. p. 37. Egypt.
 — *wollastoni*, Baly, Trans. Ent. Soc. Lond. 1877, p. 167. Cape Colony.
C. dunbrodensis, Jac., Trans. Ent. Soc. Lond. 1906, p. 17. Cape Colony.
 — *zea*, Bryant, Ann. & Mag. Nat. Hist. xvii. 1926, p. 407. Sierra Leone.

Key to the Species.

- 1 (54). Head without transverse carina.
 2 (13). Head impunctate.
 3 (4). Eyes very prominent; colour metallic bronze; antennæ with the six basal joints flavous; form ovate. *metallica*, Bryant.
 4 (3). Eyes not prominent; colour bronze-black; antennæ flavous.
 5 (10). Humeral callus well marked, form subquadrate.
 6 (7). Punctuation of the elytral striæ stronger than that on the prothorax; size 2 mm. *compressipes*, Baly.
 7 (6). Punctuation of the elytral striæ not much coarser than that on the prothorax.
 8 (9). Shining black, legs and antennæ fuscous; size 1·25 mm. *subquadrata*, Jac.
 9 (8). Legs and antennæ flavous; size 1·25–1·50 mm. *zea*, Bryant.
 10 (5). No humeral callus, form convex and tapering.
 11 (12). Punctuation of the prothorax very fine; elytra broad and convex, almost gibbous. *subaterrima*, Jac.
 12 (11). Punctuation of the prothorax fine; elytra elongate, less convex *turneri*, sp. n.
 13 (2). Head punctate.
 14 (33). Head with scattered punctures near the inner margin of the eyes, or at the base.
 15 (16). Two impressions at the base of the prothorax *natalensis*, Baly.
 16 (15). No impressions at the base of the prothorax.
 17 (24). Broadly elongate.
 18 (19). Punctuation rugose; reddish cupreous . . *purpurea*, Jac.
 19 (18). Punctuation not rugose; colour æneous.
 20 (23). Anterior angles of the prothorax not prominent.
 21 (22). Antennæ very long in both sexes, in male twice as long as the body *longicornis*, Jac.
 22 (21). Antennæ shorter than the elytra *tablensis*, sp. n.

- 23 (20). Anterior angles of the prothorax very prominent..... *bevinsi*, sp. n.
- 24 (17). Form ovate.
- 25 (32). Not very convex.
- 26 (31). Punctuation of the elytra much stronger than that on the prothorax.
- 27 (30). Antennæ extending beyond the middle of the elytra *capensis*, sp. n.
- 28 (29). Head with strong punctures along the base interrupted in the middle *mashonana*, Jac.
- 29 (28). Head with strong punctures along the base not interrupted in the middle *darwini*, sp. n.
- 30 (27). Antennæ very short, not extending beyond the middle of the elytra.
- 31 (26). Punctuation of the elytra not much stronger than that of the prothorax.
- 32 (24). Form very convex, almost gibbous *frerensis*, Jac.
- 33 (14). Head entirely punctate.
- 34 (39). Form elongate and oblong; scutellum transverse.
- 35 (36). Punctuation of the elytral striæ stronger than that on the prothorax *chalcea*, Har.
- 36 (35). Punctuation of the elytral striæ very little stronger than that on the prothorax.
- 37 (38). Antennæ as long as the body *gahani*, Jac.
- 38 (37). Antennæ extending beyond the apex of the elytra..... *marshalli*, Jac.
- 39 (34). Form ovate; scutellum small and triangular.
- 40 (44). Colour æneous.
- 41 (47). Base of the prothorax as wide as the base of the elytra.
- 42 (43). Antennæ entirely fuscous *wollastoni*, Baly.
- 43 (42). Apical joints of the antennæ black and elongate *abyssinica*, Jac.
- 44 (40). Colour black.
- 45 (46). Prothorax without stronger punctures along the base *njalensis*, sp. n.
- 46 (45). Prothorax with a row of stronger punctures along the base *sierraleonis*, sp. n.
- 47 (41). Prothorax much narrower at the base than the base of the elytra.
- 48 (53). Front and hind margins of prothorax about equal in width.
- 49 (50). Head and prothorax coppery, elytra blue; punctuation of prothorax as coarse as that on elytra *varicolor*, Jac.
- 50 (49). Colour æneous; punctuation of the prothorax much finer than that of the elytra.
- 51 (52). First joint of the antennæ fuscous *semiregulata*, Jac.
- 52 (51). First joint of the antennæ flavous..... *antennata*, Jac.
- 53 (48). Base of the prothorax distinctly wider than the front *montana*, sp. n.
- 54 (1). Head transversely carinate.
- 55 (56). Head with one transverse carina *cristata*, Har.
- 56 (55). Head with two or three transverse carinæ.

- 57 (58). Head with two carinæ; puncturation of the prothorax much finer than that of the elytra..... *congoana*, n. n.
 58 (57). Head with three transverse carinæ; puncturation of the prothorax nearly as strong as that of the elytra *malvernensis*, sp. n.

Species unknown to me.

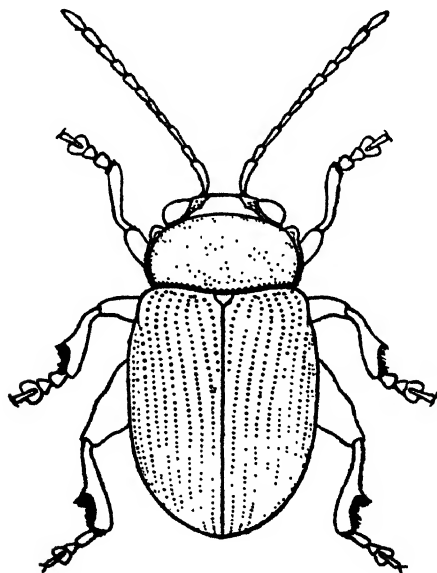
- Chætoenema pulla*, Chap., Ann. Mus. Civ. Gen. xv. p. 14. Abyssinia.
 — *acutangula*, Wse., Kili. Mer. Exped. no. 7, p. 222. Kilimanjaro.
 — *vincenti*, Reitt., Ent. Ztg. Wien, xxv. p. 37. Egypt.
 — *bilunulata*, Demais., Bull. Soc. Ent. Fr. 1902, p. 24. Luxor.

The types of all the new species are in the British Museum.

Chætoenema tablensis, sp. n. (Fig. 1.)

Elongate, parallel, dull æneous, the basal joints of the antennæ, the tibiæ, and tarsi reddish fulvous; head very

Fig. 1.



Chætoenema tablensis, sp. n.

broad, with the vertex smooth, a few large punctures near the inner margin of the eyes; prothorax finely and closely

punctured, elytra strongly punctate-striate, with the interstices smooth.

L. 3 mm.

Head broad, with the eyes rather prominent, rugosely punctured near the inner margin of the eyes, clypeus and vertex smooth; the antennæ reddish fulvous with the terminal joints fuscous, extending to about the middle of the elytra, the first joint long, about equal to the second and third together, the third joint longer than the fourth, the fourth and the remaining joints about equal to each other. Prothorax transverse, a little wider than the head, finely and fairly closely punctured, the sides margined and almost straight, the anterior angles blunt and prominent. Scutellum subtrigonal and impunctate. Elytra oblong, rounded at the apex, a very little broader than the prothorax, three times as long as the prothorax, very strongly punctate-striate, with the intervals smooth. Legs with the tibiæ and tarsi reddish flavous, the femora dull æneous. Underside æneous, the ventral segments about equal to each other, with a few large scattered punctures; metasternum longitudinally impressed and impunctate.

SOUTH AFRICA: Table Mt., 1906 (*W. Bevins*).

Allied to *C. purpurea*, Jac., by its oblong form, differs in colour, in its broader head with the vertex impunctate (in *C. purpurea* the head is distinctly punctate, though described as impunctate), and the elytral punctures are stronger and not so close.

Chaetonema darwini, sp. n. (Fig. 2.)

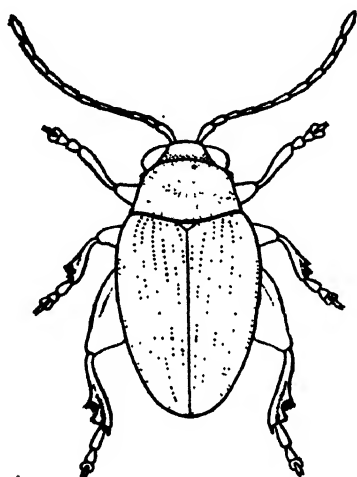
Elongate, pointed posteriorly; coppery, without greenish tinge, the three basal joints of the antennæ, the tibiæ, and the tarsi fulvous; head sparingly but strongly punctured between and behind the eyes; prothorax finely punctate; elytra strongly punctate-striate, the intervals almost flat.

L. 2.5-3 mm.

Head broad, with a few large punctures near and behind the eyes, the sides with a deep oblique groove, the front smooth, the sides below the eyes punctured; the antennæ extending almost to the apex of the elytra, much shorter in the female, the three basal joints fulvous and the rest darker, with the base of each joint pale, the basal joint longer than the second, the third to the eleventh about equal to each other. Prothorax broader than long, the sides nearly straight, contracted in front, anterior angles blunt, finely punctured

and finely granulate, a row of strong punctures along the basal margin. Scutellum transverse, impunctate. Elytra elongate, pointed posteriorly, strongly and regularly punctate-striate, intervals very finely granulate and almost flat. Legs with the femora metallic, the two front pairs at the apex tinged with fulvous, the hind pair strongly incrassate. Underside dark æneous; the first two ventral segments longer than the following, all with scattered punctures.

Fig. 2.

*Chaetocnema darwini*, sp. n.

SOUTH AFRICA: Cape of Good Hope (*C. Darwin*); Table Mt., 1906 (*W. Bevins*).

This species is very closely allied to *C. mashonana*, Jac., but can be distinguished by its brassy colour, which is constant in eighteen specimens before me; also the æneous colour of *C. mashonana* appears to be constant; it further differs in being not so convex, the puncturation of the prothorax finer, and the three basal joints of the antennæ fulvous.

Chaetocnema sierraleonis, sp. n. (Fig. 3.)

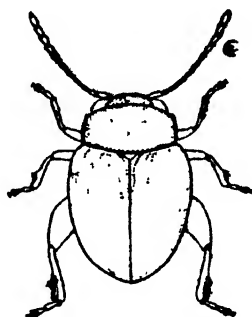
Ovate; dark æneous above and below, antennæ, with the exception of the four terminal joints, fulvous, tibiæ and tarsi

flavous; head very finely and not closely punctured; prothorax very finely punctured; elytra strongly punctate-striate, with the intervals feebly convex.

L. 1.5 mm.

Head finely but not closely punctured; the clypeus broad, impunctate; the antennæ extending to the middle of the elytra, flavous, with the four terminal joints more or less fuscous, the two basal joints stout, the first twice as long as the second. Prothorax transverse, nearly twice as broad as long, very finely but not closely punctured, with a row of strong punctures along the base, the sides almost straight, strongly margined, with the anterior angles well marked. Scutellum impunctate. Elytra ovate, the base a little broader

Fig. 3.



Chaetocnema sierraleonis, sp. n.

than the prothorax, strongly punctate-striate, with the intervals feebly convex. Legs with the tibiae and tarsi flavous, the front and middle femora fuscous, the hind pair darker. Underside dark æneous.

SIERRA LEONE: Boia, 11. x. 1925 (*E. Hargreaves*).

Somewhat allied to *C. compressipes*, Baly, but differs in its smaller size, finely punctate head, and prothorax more transverse.

Chaetocnema bevinsi, sp. n. (Fig. 4.)

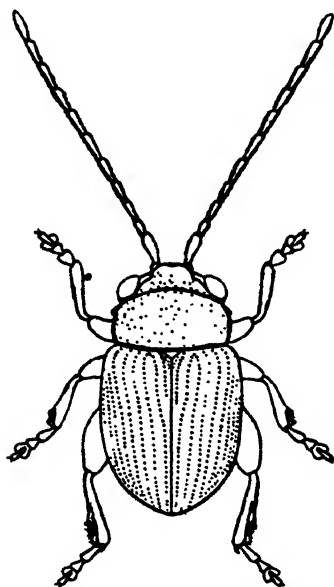
Oblong; dark æneous, the base of the lower joints of the antennæ and the tarsi fulvous; head with scattered punctures behind the eyes; prothorax strongly punctured; the elytra

coarsely punctate-striate; femora and tibiae dark æneous and the tarsi fulvous.

L. 2.5 mm.

Head broad, eyes large and prominent; a fine oblique groove at each side, a few large scattered punctures at the base behind the eyes; antennæ in the male very long, extending to the apex of the elytra, in female much shorter, dark æneous, with the four basal joints fulvous at the base, the remainder darker, the first joint stout and nearly equal to

Fig. 4.



Chætocnema bevinisi, sp. n.

the second and third combined, the second joint half as long as the third, the third to the eleventh about equal to each other. Prothorax transverse, strongly punctured, the sides almost straight, margined, and the anterior angles strongly produced and prominent. Scutellum triangular, impunctate. Elytra with rows of deep coarse punctures, the rows near the suture with the punctures more closely placed, the intervals smooth and flat. Legs dark, with the tarsi fulvous, the first joint of the front and middle pairs more swollen. Underside

dark æneous; the first two ventral segments smooth, with a few large scattered punctures, the second segment about equal to the third and fourth together.

Female with the underside more strongly punctured, the antennæ shorter, and the tarsal joints not so swollen.

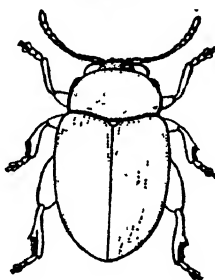
SOUTH AFRICA: Table Mt., 1906 (*W. Bevins*).

A distinct species on account of the well-marked anterior angles of the prothorax.

Chaetocnema njalensis, sp. n. (Fig. 5.)

Oblong, not very convex, somewhat flattened, nigrescent; the antennæ, front and middle legs, and the hind tibiæ and tarsi pale fulvous; the head very finely punctured; the

Fig. 5.



Chaetocnema njalensis, sp. n.

prothorax finely and evenly punctured; the elytra strongly punctate-striate, with the intervals almost flat.

L. 1.75 mm.

Head black, shining, very finely and closely punctured, with deep oblique grooves at the sides; the antennæ pale fulvous, short and stout, extending only a little beyond the base of the prothorax, the first joint longer than the second, the third to sixth more slender, and the five terminal joints stouter. Prothorax transverse, a good deal broader than the head and almost as broad as the base of the elytra, finely and evenly punctured, with a row of stronger punctures along the basal margin, the sides very slightly rounded, with the anterior angles obtuse. Scutellum transverse, impunctate. Elytra oblong, three times as long as the prothorax, rounded at the apex, the base a very little wider than the prothorax;

strongly punctate-striate, with the sutural striæ finer and more confluent, the intervals smooth and almost flat, slightly more convex towards the apex. Legs pale fulvous, with the hind femora fuscous, and with traces of fuscous on the front and middle femora. Underside fuscous, with the ventral segments about equal and strongly punctured.

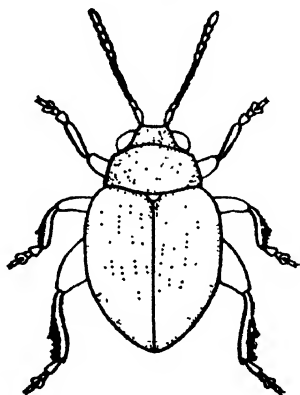
SIERRA LEONE: Njala, x. 1926 (*E. Hargreaves*).

A very distinct species, and not closely allied to any known African species, having a more flattened appearance.

Chaetocnema montana, sp. n. (Fig. 6.)

Broadly ovate; æneous, the legs and antennæ fulvous; head small, with strong scattered punctures; prothorax

Fig. 6.



Chaetocnema montana, sp. n.

strongly and remotely punctured; elytra punctate-striate, the interstices impunctate, pointed at apex.

L. 2 mm.

Head small, rather strongly punctured, the front clothed with ashy pubescence; head with eyes narrower than the prothorax; antennæ short, fulvous, with the five apical joints fuscous, extending to about the middle of the elytra, the two basal joints more swollen, joints 3 to 6 more slender, the five apical ones shorter and broader. Prothorax broader than the head, strongly and remotely punctured, slightly transverse and a little contracted in front. Scutellum impunctate.

Elytra a good deal broader than the prothorax, widest behind the middle, with the apex somewhat pointed, strongly punctate-striate, the punctures well separated, the interstices impunctate. Legs fulvous, with the hind femora slightly æneous. Underside æneous; the first ventral segment strongly punctured, twice as long as the second, the second less strongly punctured and about equal to the third and fourth together.

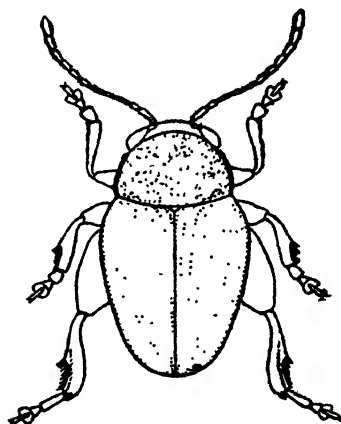
SOUTH AFRICA: Table Mt., 1906 (*W. Bevins*).

Allied to *C. antennata*, Jac.

Chætocnema turneri, sp. n. (Fig. 7.)

Dark æneous; the basal joints of the antennæ, the tibiæ, and tarsi flavous; the head smooth, the prothorax closely and

Fig. 7.



Chætocnema turneri, sp. n.

finely punctured; the elytra strongly punctate-striate, the interstices smooth, the apex pointed.

L. 2.2-2.25 mm.

Elongate, and markedly narrowed behind; the vertex of the head smooth, the eyes large, with a deep sulcus near their inner margin; the antennæ extending to the middle of the elytra, the seven basal joints flavous, the four apical joints with their apical half fuscous, the basal joint elongate, about equal to the second and third together. Prothorax broader than long, strongly convex, very finely and closely punctured,

the sides strongly margined, with the anterior angles depressed and thickened, a few strong punctures near the basal angles. Elytra widest just behind the shoulders, and then tapering to the apex, strongly punctate-striate, with the interstices smooth, the sides very feebly longitudinally costate. Legs flavous, with the exception of the middle and hind femora, which are piceous. Underside piceous; the first ventral segment strongly punctured, the remainder smooth, with scattered golden pubescence.

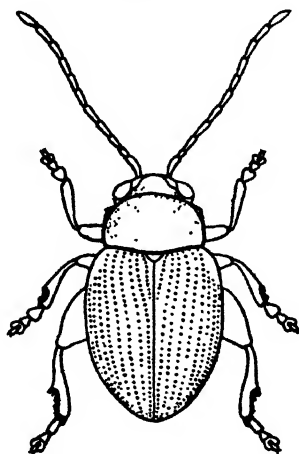
SOUTH AFRICA: Gingindhlovu, Zululand, 9-15. vi. 1926 (R. E. Turner).

Closely allied to *C. subaterrima*, Jac.

Chætocnema capensis, sp. n. (Fig. 8.)

Ovate; dark æneous, the antennæ and legs (with the exception of the hind femora) fulvous; prothorax very finely

Fig. 8.



Chætocnema capensis, sp. n.

punctured; elytra strongly punctate-striate, the interstices longitudinally slightly convex.

L. 2.5 mm.

Head broad, with a few strong punctures near the inner margin of the eyes, a feeble longitudinal carina between the insertions of the antennæ, the base and vertex impunctate and very finely granulate; the antennæ extending well beyond

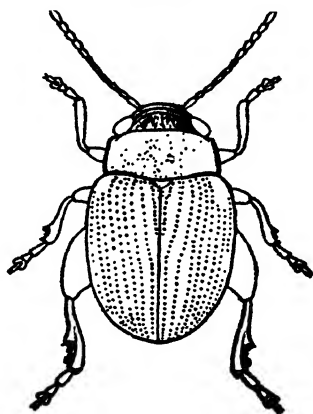
the middle of the elytra, fulvous, the five apical joints slightly tinged with fuscous. Prothorax transverse, a little broader than the head, very finely punctured, more feebly so towards the base, with a few strong punctures along the basal margin, the sides slightly rounded, the anterior angles well marked and blunt. Scutellum slightly transverse, impunctate. Elytra punctate-striate, the punctures being very large, the lateral striæ with the punctures wider apart, the intervals slightly longitudinally convex and smooth. Legs fulvous, with the hind femora æneous, the middle and hind tibiæ strongly toothed, the front tarsi with the first joint swollen in male. Underside æneous; the ventral segments with short ashy pubescence, the second segment equal to the third and fourth together.

SOUTH AFRICA: Table Mt., 19. viii. 1905 (G. A. K. Marshall).

Chætoenema malvernensis, sp. n. (Fig. 9.)

Metallic dull green; head with three transverse ridges;

Fig. 9.



Chætoenema malvernensis, sp. n.

antennæ, tibiæ, and tarsi flavous, the femora fuscous; prothorax with large scattered punctures; elytra strongly punctate-striate.

L. 2 mm.

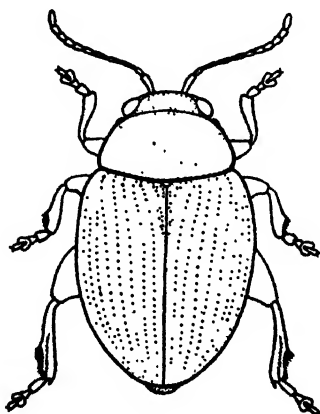
Head elongate, perpendicularly deflexed, the clypeus triangularly emarginate, very strongly and remotely punctured, the vertex with three well-defined transverse ridges, its base

strongly rugose; the antennæ not extending to the middle of the elytra, flavous, with the four apical joints tinged with fuscous, the first joint broader and longer than the second, the third long and slender, longer than the second or fourth, the remaining joints about equal to each other. Prothorax very transverse, twice as broad as long, the sides margined and slightly rounded, narrowed in front, with the anterior angles obtuse; the surface minutely granulate, strongly and not very closely punctured. Scutellum transverse, impunctate. Elytra slightly broader than the base of the prothorax, about three times as long, rounded at apex, strongly punctate-striate, the interstices with a few fine punctures and slightly convex. Legs with the tibiæ and tarsi flavous, the femora tinged with fuscous, the intermediate and hind tibiæ strongly toothed.

NATAL: Malvern, 1. i. 1907 (*C. N. Barker*). S. RHODESIA: Marandellas, i. 1897 (*G. A. K. Marshall*).

This species is allied to *C. cristata*, Har., and *C. carinata*, Jac. It differs from *C. cristata* in having three ridges instead of one on the head. Jacoby's description is incorrect, the type of *C. carinata* has only two ridges, and its size is quite 3 mm. This new species differs also in the much stronger punctuation on the prothorax. The name of *C. carinata*, Jac., is preoccupied, and *C. congoana*, nom. nov., is here proposed instead.

Fig. 10.



Chaetocnema wollastoni, Baly.

LIII.—*Two new S. W. African Mongooses.*

By OLDFIELD THOMAS.

THE two following remarkably dark mongooses have been discovered by Capt. Shortridge in Kaokoland, and may conveniently be now described.

[*MYONAX*, gen. nov.

Genotype. *M. gracilis* (*Herpestes gracilis*, Rüpp.).

A new generic name for the common small African mongooses for which Dr. Allen has used the name *Galerella*. But *Galerella ochracea*, the genotype, is in many respects peculiar, especially in the structure of its feet, and the ordinary species should not be considered congeneric with it. Further details will be given in a general paper on Capt. Shortridge's collection.]

Myonax nigratus, sp. n.

A dark mongoose of the "*nutgigella*" type of coloration. Dorsal area from crown down centre of back black; sides from ears to hips Prout's brown. Under surface also dark brown. Cheeks and throat more greyish, with some white tickings. Hand and feet dark brown. Tail black, browner proximally below.

Head and body of type 340 mm.; tail 325; hind foot 70.

Skull: greatest length 68.

Hab. Kaokoland. Type from Okorosave.

Type. Adult male. B.M. no. 28. 9. 11. 104. Original number 3718. Collected by Capt. G. C. Shortridge.

Helegale parvula nero, subsp. n.

A remarkably blackened form, many of the thirty specimens available absolutely deep black throughout—head, body, and tail,—a majority black with a few fine tickings on head and shoulders, and a small minority scarcely darker than true *H. parvula*, although the hairs are ringed with black instead of brown. Type of the slightly ticked form.

Head and body of type 225 mm.; tail 165.

Skull: greatest length 49.

Hab. Kaokoland. Type from Okorosave.

Type. Adult female. B.M. no. 28. 9. 11. 121. Original number 3715. Collected by Capt. G. C. Shortridge.

LIV.—*A new Echimys from Eastern Ecuador.*

By OLDFIELD THOMAS.

IN the large collection of Ecuadorean mammals left by the late Consul L. Söderström there occurs a specimen of the following new spiny rat :—

Echimys saturnus, sp. n.

A large dark-coloured species most nearly allied to *E. chrysurus*, with which it shares the large size, the long pelage—both hairs and spines,—and the long tapering well-haired tail, with white tip.

General colour above very dark, the head, muzzle, cheeks and crown, and the whole middle region of the back deep black; no whitish crest on the head. Sides from below ears to hips dark coppery, the spines, however, slaty with black tips. Under surface with broad sharply defined white patches in the sternal and inguinal regions, connected by a narrow median white line along the belly, the sides of the belly dull brown, tinged with coppery. Chin blackish; interramina white, succeeded by a brown band. Limbs darkening terminally, the hands and feet black. Tail long, thickly covered with stiff hairs, deep black in continuation with the middle line of the back, the tip dull white for about an inch, with a tendency to white rather farther up.

Skull very like that of *E. chrysurus*, agreeing in size and general characters, but the supraorbital ridges of the type are less heavy than those of an old *chrysurus*.

Dimensions of the type, measured on the remade skin :—

Head and body 335 mm.; tail 295; hind foot 51; ear 17.

Skull: greatest length 67·5; condylo-incisive length 60; zygomatic breadth 31·3; nasals $21 \times 8\cdot5$; interorbital breadth 19; mastoid breadth 24·5; palatilar length 26; upper cheek-teeth 14.

Hab. Rio Napo, Oriente of Ecuador. Alt. 3300'.

Type. Adult male. Provisional number 471. Captured 12th February, 1921, by Mr. Söderström's collector. One specimen.

While no doubt essentially allied to *E. chrysurus*, this fine spiny rat is distinguishable by the absence of a white crown-patch, by its deep black head and centre area of the back, its copper-coloured sides, white middle line below, and nearly wholly black tail.

The other large Amazon species—*E. grandis*—has a completely different pelage, the spines and hairs uniformly short, the under surface dull yellowish brown, the tail wholly black.

Mr. Söderström's collection also includes topotypical and representative examples of most of the species and subspecies described by Prof. Lönnberg, such as *Dinomys branickii occidentalis*, *Myoprocta pratti archidonæ*, *Dactylomys dactylinus modestus*, and others. There are, in addition, two specimens of the beautifully coloured *Mystax tripartitus*, M.-Edw., a species not recorded since its original description in 1878.

LV.—Notes on Cyclocœlidæ.

By G. WITENBERG.

(From the Microbiological Institute, Hebrew University, Jerusalem.)

DURING the dissection of water-birds caught at the mouth of the Jordan two new species of the Trematode genus *Hyptiasmus*, Kossack, were found. I propose to name them *Hyptiasmus magniproles*, sp. n., and *H. theodori*, sp. n. The latter name is dedicated to my colleague, Dr. O. Theodor, to whom I am indebted for assistance in securing the material on which the present paper is based.

Hyptiasmus magniproles, sp. n. (Fig. 1.)

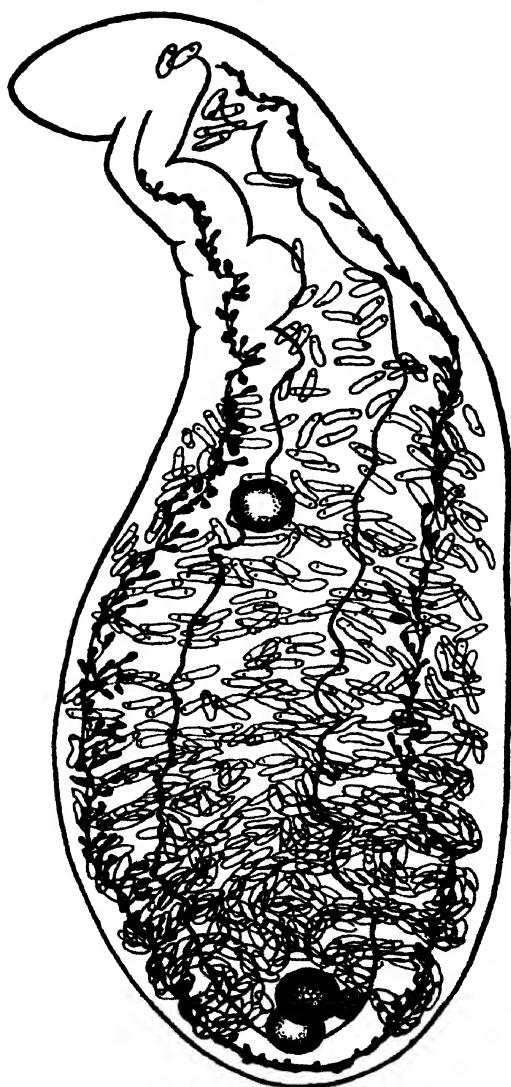
One specimen of this species was found in the infra-orbital cavity of *Himantopus candidus* (Av.P. 3).

Body pear-shaped, 8.0 mm. long, 2.4 mm. wide, the maximal width being in the hind part. Unfortunately, during the mounting of the specimen its anterior extremity was bent, thus making the investigation of the contained organs impossible.

The intestinal limbs are wide, their inner margin is wavy and the outer one is straight. At the extreme posterior end of the body they converge and unite forming an arc which is narrower than any other part of the intestine.

One of the two globular testes is situated at the inner margin of the intestinal arc, while the other adheres to the inner margin of the right intestinal limb almost in the middle of the length of the body. The testes are equal in size, being 0.32 mm. in diameter. The globular ovary is 0.40 mm.

Fig. 1.



Hyptiasmus magniproles, sp. n. (Av.P. 3.) $\times 20$.

in diameter and lies immediately in front of the posterior testis. To the left of the ovary a small shell-gland is situated.

The vitellaria consist of small pear-shaped follicles which run along the whole length of the outer margin of the intestine including the arc. They are weakly developed, but give rise to small branches which spread along the dorsal and ventral surface of the intestine.

The uterine coils occupy the whole free space in the posterior part of the body, passing from one margin to the other, but do not extend posteriorly beyond the posterior testis; in the anterior part of the body they are confined between the intestinal limbs.

The ova are 0·18–0·20 mm. long (in mounted preparations), are thin-shelled, and can be traced only at the beginning of the uterus, for already in the middle third of the body the miracidia escape and empty shells are seen. The miracidia, which are provided with double pigment-spots, grow as they approach the genital aperture. Near the intestinal bifurcation they are up to 0·31 mm. in length.

This species differs from other species of the same genus in the position of the anterior testis which in no species is removed so far from the posterior one as in *H. magniproles*, and from all members of the family Cyclocœlidæ as well as from all Trematodes by its uncommonly large miracidia.

A special particularity of this species should be pointed out. In a previous paper I called attention to the fact that all members of the genus *Hyptiasmus* are parasites of birds belonging to the family Anseridæ. *Hyptiasmus magniproles* is, however, exceptional in having a Charadriid bird as host.

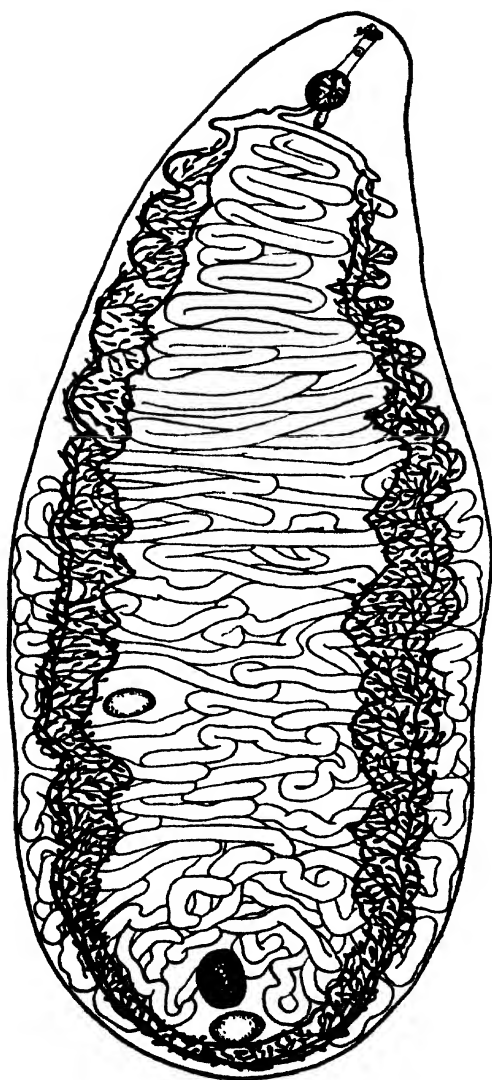
Hyptiasmus theodori, sp. n. (Fig. 2.)

A single specimen was found in the infraorbital cavity of *Dafila acuta* (Av. 13).

The flattened worm is 14·0 mm. long, 5·5 mm. wide. The lateral borders of the posterior half of the body are almost parallel, while anteriorly the body tapers.

The oral opening is situated subventrally. The præpharynx is 0·62 mm., the pharynx 0·50 mm., the œsophagus 0·43 mm. long. The intestinal limbs are narrow at the beginning, but soon become very wide; near the posterior extremity of the body they unite to form an arc. The inner margin of the intestine is wavy, while the outer is provided with short cæca which are distributed irregularly and are largest just behind the intestinal bifurcation.

Fig. 2.



Hyptiasmus theodori, sp. n. $\times 10$.

The testes are transversely oval. The posterior one is 0.38 mm. long and 0.62 mm. wide and lies in the middle of the intestinal arc, while the anterior one is 0.37 mm. long and 0.54 mm. wide and adheres to the inner margin of the right intestinal limb between the middle and posterior third of the body. The oval ovary has the long diameter longitudinal and lies just in front of the posterior testis; its size is 0.72×0.52 mm. Behind the ovary a small body, probably the seminal receptacle, can be distinguished.

The vitellaria lie along the whole intestine, including the arc, but not spread over the bifurcation. They are well developed, and their ramifications embrace the intestine dorsally and ventrally.

The uterine coils cross the body in its posterior half from one border to the other, while in the anterior part of the body they are confined between the intestinal limbs. Posteriorly they do not extend beyond the posterior testis; they are not as tightly packed as in many other species of the same genus.

The genital aperture is situated at the level of the middle of the præpharynx. The narrow cirrus pouch reaches the intestinal bifurcation.

The oval thin-shelled eggs are 0.100–0.108 mm. long in the initial parts of the uterus, while in the terminal portion they reach 0.155 mm. in length and 0.092 in width (in fresh material).

Hyptiasmus theodori resembles *H. tumidus*, Kossack, 1911, in most respects, but differs from it, as well as from other species of the same genus, in the presence of lateral cæcal dilatations of the intestine.

During the preparation of my last paper on the Trematode family Cyclocœlidæ (1926) I was obliged to omit the consideration of some species the original descriptions of which were inaccessible to me. I have since had the opportunity of consulting these original descriptions and suggest the following criticisms:—

In his paper of 1917, Johnston described three new species of Cyclocœlidæ: *Cyclocœlum tazorchis*, *Hyptiasmus magnus*, and *Hæmatotrephus adelphus*.

In *Cyclocœlum tazorchis* the testes are situated side by side, the ovary in front of them, the vitellaria do not flow together on the intestinal arc; this species should therefore be placed in the genus *Wardianum*, Witenberg, 1926. Only one other species of this genus is known—*Wardianum triangularum* (Harrah, 1922), but it differs so little from Johnston's

species that it is probable that these two species are identical. As may be seen from the following table, the differences between them can be regarded as a sign of age but not as specific characters :—

	Testes.	Ovary.	Position of ovary.	Eggs.
<i>W. tavorchis</i> ..	1.3×0.87	0.44	On the right side of the middle line.	0.132×0.075
<i>W. triangularum</i>	0.41	0.24	On the middle line.	0.117–0.139 ×0.059

Hyptiasmus magnus, Johnston, 1917, possesses the characters of the tribe *Hyptiasmea*, Witenberg, 1926, but its vitellaria do not flow together on the intestinal arc and therefore this species should be placed in the genus *Prohyptiasmus*, Witenberg, 1926.

I designated *Cyclocœlum robustum*, Stossich, as the type-species of the genus *Prohyptiasmus*. I did so without consulting the original description of Stossich, but on the basis of Kossack's discussion. However, on reading Stossich's description, I came to the conclusion that if this description and the corresponding figures are reliable, *Cyclocœlum robustum*, Stossich, belongs not to the genus *Prohyptiasmus* but to *Harrahium*, Witenberg, 1926, because of the position of the ovary, and therefore its correct name should be *Harrahium robustum* (Stossich, 1903). Thus the genus *Prohyptiasmus* has lost its type, and should be regarded as a synonym of the genus *Harrahium*. Hence for *Hyptiasmus magnus* a new genus must be established. I propose to name it *Stossichium*, gen. nov., with *S. magnum* (Johnston, 1917) as type-species. The diagnosis of this genus remains the same as that of the rejected genus *Prohyptiasmus*.

Hæmatotrephus adelphus, Johnston, 1917, must be transferred into the genus *Uvitellina*, Witenberg, 1926, because of the structure of the vitellaria which flow together on the intestinal arc. Thus the correct name of this species should be *Uvitellina adelpha* (Johnston, 1917). It is similar to *U. magnimbria*, Witenberg, 1926, possessing equally large miracidia, but differs from it in having wider and more regularly disposed uterine coils and a thinner intestine. It is, however, not unlikely that these two species will prove identical.

Morishita (1924) described two species, *Cyclocœlum vagum* and *C. distomatum*, both from Gallinaceous birds. This host peculiarity might *a priori* lead to the suggestion that

these species do not belong to the genus *Cyclocœlum*, the members of which are parasites of Charadriidæ and Rallidæ. In fact, the anatomy of these worms is different from that of the genus *Cyclocœlum*. A new genus should be created for Morishita's species, which should be placed not in the tribe Cyclocœlea but in the Hyptiasmea. In the orthogenetical table of the Cyclocœlinæ proposed in my previous paper it will occupy the cell C \times 2, i. e. it is homologous to the genus *Cyclocœlum*, Brandes, differing from it in the disposition of the genital glands. I propose to name it *Morishitium*, gen. nov.

Diagnosis.—Hyptiasmea in which the uterine coils do not cross the intestine, the vitellaria do not flow together on the intestinal arc, and the genital aperture is situated near the level of the intestinal bifurcation.

Type-species, *M. vagum* (Morishita, 1924); a second species, *M. distomatum* (Morishita, 1924).

Travassos, in his paper of 1926, described two new species, *Ophthalmophagus magalhaesi* and *Typhlocœlum neirai*, and redescribed *Typhlocœlum obovale*, Neumann, 1909.

For *Ophthalmophagus magalhaesi*, Travassos gave two figures, Nos. 1 and 2. The relation between the sizes of the pharynx to that of the body are quite different in both drawings. Similarly, the configuration of the intestine is different, since in fig. 1 the intestine is provided with lateral cæca, which do not appear in fig. 2. It is evident that Travassos's figures represent two different species, but further investigation is required to confirm this view.

Typhlocœlum neirai, Travassos, 1925, has all the characters of the genus *Typhlocœlum*, Stossich, 1903, except for one very important feature—it has no intestinal cæca. If the author has rightly observed this peculiarity a new genus should be created for this species.

The figures and description of *Typhlocœlum obovale*, Neumann, 1909, which Travassos gives clearly, show that this species is no other than *Typhlocœlum cucumerinum* (Rudolphi, 1809).

Professor C. W. Stiles, in a letter of April 22, 1927, to me, has been kind enough to call my attention to a double lapsus in my paper on Cyclocœlidæ. I there divided the genus *Cyclocœlum*, Brandes, into two subgenera, *Anthepharyngeum* and *Postpharyngeum*, without designating type-species for them. According to the Art. 9 of the International Code of Nomenclature, "the name of typical subgenus must be the same as the name of the genus." Thus the subgenus *Anteopharyngeum*, Witenberg, 1926, which is typical, should

be renamed *Cyclocœlum* with type-species *Cyclocœlum* (*Cyclocœlum*) *mutabile* (Zeder). For the subgenus *Postpharyngeum*, Witenberg, 1926, *Cyclocœlum* (*Postpharyngeum*) *obscurum* (Leidy) may be designated as type-species.

The following species should be regarded as synonyms of the latter species: *C. halcyonis*, MacCallum, *C. leidy*, Harrah, *C. obliquum*, Harrah, *C. orientale*, Skrjabin, and *C. vicarium*, (Arnsdorf).

In his recent paper (1928), Linton described a new trematode which he named *Hæmatotrephus fodiens* (from *Gavia immer*). The description of this worm does not, however, correspond to the diagnosis of the genus *Hæmatotrephus*. In fact, Linton's species does not belong to the latter genus, since the vitellaria do not joint at the posterior extremity of the worm and the uterus is comparatively feebly developed. This species seems to be closely related to the genus *Hæmatoprium*, Witenberg, 1926, and perhaps is a member of it. It must, however, be pointed out that Linton is not sure whether the intestinal branches of this species form a true arc, and the length of the eggs is too small for a Cyclocœlidæ representative. For this reason the generic identification of this species remains problematical.

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LVI.—*Review of the Species of Hoplacephala*, Macquart (Sarcophagidæ, Diptera). By C. H. CURRAN, Entomological Branch, Ottawa, Canada.

IN 1913 Dr. J. Villeneuve published a paper entitled "Sur le Genre *Hoplocephala*, Macq., et ses alliés," in which he established three new genera. The fourth genus—*Sankisius*

—I have not been able to recognize, but the others I consider as forming merely groups of the genus *Hoplcephala*, Macquart. In later contributions Dr. Villeneuve added new species and subgenera. These groups are very weakly separated from each other, being based chiefly upon the development of the bristles of the head and thorax. Since such characters are very evidently only specific, the species apparently having developed specialized bristles in the male sex, I cannot see that anything is to be gained by recognizing subgenera, since all the characters used to separate them are confined to the males. In the genus there are two distinct types of colour-pattern: in one the abdomen is wholly black in ground-colour, and in the other it is largely reddish, while in both the abdomen is chiefly pollinose, leaving almost bare vittæ or spots. I am not sure that the genus *Lamprometopia*, Macq., should not be considered an absolute synonym of *Hoplcephala*, since the characters by which it may be separated are not of major importance.

The literature dealing with the various species is scattered, and, having considerable material before me, the present time seems opportune to present a table for the determination of the various forms. In some cases I have had to rely upon the descriptions for the separation of the species. The females are all very similar in appearance and chætotaxy, and but few of them are known, but I have included in the key such of them as are known to me.

I am not aware of any reference to the habits of the immature stages, and it is surprising to learn that the larvæ live in the nests of termites and feed upon them, according to a note attached to one of the specimens by Mr. H. K. Munro. If such is the case, the genus is to be regarded as beneficial, and it is to be hoped that this information may be verified by someone in the field.

The synonymy of the genus is as follows, but in order that the various subgenera proposed by Villeneuve may be understood, a key for their separation is given:—

HOPLACEPHALA, Macquart.

Diptera Exotica, Suppl. i. p. 155 (1846). (*Hoplcephala*, Bezzi, Villeneuve.) Genotype, *tessellata*, Macq., monotypic.

Dichætometopia, Macquart, Dipt. Exotica, Suppl. v. p. 126 (1856). Genotype, *rufiventris*, Macq.

Hoplocephalopsis, Villeneuve, Rev. Zool. Afr. iii. p. 110 (1913). Genotype, *schistacea*, Vill.

Hoplocephalella, Villeneuve, Rev. Zool. Afr. iii. p. 111 (1913). Genotype, *signata*, Vill.

Sankisius, Villeneuve, Rev. Zool. Afr. iii. p. 113 (1913). Genotype, *excisus*, Vill.

Hoplocephalina, Villeneuve (subgenus), Ann. S. Afr. Mus. xv. p. 510 (1916). Genotype, *maculosa*, Vill.

Hoplocephalonsa, Villeneuve (subgenus), Bull. Soc. R. Ent. Egypte, p. 94 (1922). Genotype, *nitigena*, Vill.

Table of Genera and Subgenera.

- | | | |
|---|----|---------------------------------|
| 1. Ocellar bristles present though sometimes weak..... | 2. | |
| Ocellar bristles entirely absent | 6. | |
| 2. Face with short appressed hair; outer vertical bristles present; frontal bristles complete or nearly so; frontal vitta almost as wide as parafrontal | | <i>Hoplocephalonsa</i> , Vill. |
| Face with rather erect, abundant, longish hair; if doubtful, the frontal vitta extremely narrow | 3. | |
| 3. Middle tibiae with two or more antero-dorsal bristles | 4. | |
| Middle tibiae with a single antero-dorsal bristle situated near the middle; parafrontals rather silvery | | <i>Lamprometopia</i> , Macq. |
| 4. Front with only proclinate orbitals | 5. | |
| A pair of reclinate orbitals above the proclinate ones; one or two pairs of anterior acrostichals | | <i>Sankisius</i> , Vill. |
| 5. One or two pairs of presutural acrostichal bristles | | <i>Hoplocephalella</i> , Vill. |
| No presutural acrostichals | | <i>Hoplocephalopsis</i> , Vill. |
| 6. Frontal row of bristles complete or nearly so; an oblique row of strong setae near the inner edge of the parafacials; pre-scutellars weak | | <i>Hoplocephalina</i> , Vill. |
| Cruciate frontals limited to lower third of front, although there may be one or more pairs of strong, reclinate, or otherwise specialized bristles isolated from the frontals proper; inner rows of hairs on parafacials scarcely stronger than elsewhere | | <i>Hoplacephala</i> , Macq. |

Note.—The subgenus *Dichætometopia*, Macq., cannot be placed, but the name will have precedence over one of those proposed by Villeneuve.

Table of Species.

- | | | |
|---|----|-------------------------------|
| 1. Middle tibiae with two or more antero-dorsal bristles | 2. | |
| Middle tibiae with a single antero-dorsal bristle situated a little beyond the middle | | [Macq.] |
| 2. Hair of parafacials appressed; genitalia reddish; ocellar and outer vertical | | <i>Lamprometopia caffra</i> , |

- bristles present; three pairs of rather weak orbitals; palpi reddish..... *nitidigena*, Vill.
- Hair of parafacials rather dense and mostly erect; genitalia usually black 3.
3. Ocellar bristles absent..... 9.
- Ocellars present though sometimes weak.. 4.
4. Males: abdomen usually largely reddish .. 5.
- Females: abdomen usually all black 18.
5. One or two pairs of presutural acrostichal bristles; ocellars weak 6.
- No presutural acrostichals; ocellars strong, more or less divergent or reclinate 8.
6. Male with reclinate orbital above the proclinate ones; third antennal segment three times as long as second *excisus*, Vill.
- Male without reclinate orbital; third antennal segment not more than twice as long as second 7.
7. Mesonotum greyish or greyish brown, with five narrow black vittæ which are not continued over the scutellum; pleura grey *grisea*, Vill.
- Mesonotum dull, with two deep black vittæ which are continued over the sides of the scutellum; pleura shining black .. *signata*, Vill.
8. Palpi black *schistacea*, Vill.
- Palpi reddish *testacea*, Vill.
9. With one or more pairs of reclinate or more or less specialized frontal bristles, or the frontals nearly complete..... 13.
- With three or four pairs of cruciate frontals on lowest third of front..... 10.
10. Outer vertical bristles absent..... 11.
- Outer vertical bristles present *nigriventris*, Vill.
11. Black median spot on the second abdominal segment widest basally 12.
- Black spot on second segment widest apically, the base of the segment densely pale pollinose *inermis*, Vill.
12. Abdomen with a very broad black vitta lying beneath the lateral margins..... *lateralis*, sp. n.
- Abdomen without lateral black vitta beneath *rufiventris*, Macq.
13. None of the frontal setæ more than two-thirds as long as head-height 14.
- A pair of exceedingly long wavy frontal bristles which are almost or quite as long as head-height..... *tessellata*, Macq.
14. Frontals of almost equal strength and rather evenly spaced 15.
- A pair of strong, isolated, reclinate frontals situated near the middle of the front .. *retroseta*, Vill.
15. Abdomen largely reddish 16.
- Abdomen wholly black in ground-colour.. 17.
16. Mesonotum subopaque, black..... *stannusi*, sp. n.
- Mesonotum grey, black vittate *irvingi*, sp. n.

- | | |
|---|----------------------------|
| 17. Eyes of both sexes thickly haired | <i>maculosa</i> , Vill. |
| Eyes almost bare | <i>pubera</i> , Vill. |
| 18. Abdomen black in ground-colour | 19. |
| Abdomen largely reddish in ground-colour. | <i>anorubra</i> , Vill. |
| 19. Palpi blackish | 20. |
| Palpi reddish | <i>testaceu</i> , Vill. |
| 20. With a pair of strong prescutellar bristles . | 20. |
| With very weak hair-like prescutellars .. | <i>maculosa</i> , Vill. |
| 21. With four pairs of moderately spaced | |
| orbitals | 22. |
| With six pairs of closely spaced orbitals .. | <i>irvingi</i> , sp. n. |
| 22. Scutellum wholly black in ground-colour. . | <i>grisea</i> , Vill. |
| Apex of scutellum broadly reddish | <i>rufiventris</i> , Macq. |

Hoplacephala nitidigena, Villeneuve.

Hoplacephala (Hoplocephalona) nitidigena, Villeneuve, Bull. Soc. R. Ent. Egypte, p. 94 (1922).

This is the only record of the genus from Northern Africa, the type-specimen being from Egypt.

Hoplacephala excisus, Villeneuve.

Sankisius excisus, Villeneuve, Rev. Zool. Afr. iii. p. 113 (1913).

Described from the Belgian Congo. I have not seen specimens referable to this subgenus.

Hoplacephala signata, Villeneuve.

Hoplocephalella signata, Villeneuve, Rev. Zool. Afr. iii. p. 112 (1913).

I have not seen this species, which was described from Durban, Natal.

Hoplacephala grisea, Villeneuve.

Hoplocephalella grisea, Villeneuve, Ann. S. Afr. Mus. xv. p. 509 (1916).

♂, Pretoria, 9. ix. 1917 (*H. K. Munro*); ♀, Umbilo, Durban, Natal, 22. ii. 1914 (*L. Bevis*).

In this species the middle tibiae bear only two antero-dorsal bristles, one of them well beyond the middle.

Hoplacephala anorubra, Villeneuve.

Hoplocephalella anorubra, Villeneuve, Rev. Zool. Afr. viii. p. 157 (1920).

Described from a ♀ from Cape Province, in which the abdomen is mostly reddish. This is an unusual coloration for this sex.

Hoplacephala schistacea, Villeneuve.*Hoplocephalopsis schistacea*, Villeneuve, Rev. Zool. Afr. iii. p. 111 (1913).

This species, which was described from the Belgian Congo, is very similar to the following. I have not seen it.

Hoplacephala testacea, Villeneuve.*Hoplocephalopsis testacea*, Villeneuve, Rev. Zool. Afr. iii. p. 116 (1913).

2 ♂, 3 ♀, Barberton, v. 1913, 1914 (*H. K. Munro*), and 2 ♂, viii. 1913 (*L. S. Hulley*); 1 ♂, 6 ♀, Pretoria, i., ii., vi., ix., x., xii., 1 ♂, Port Shepstone, 4. viii. 1920, and 1 ♀, Kaapmuiden, 27. viii. 1924 (*H. K. Munro*); 2 ♀, Buluwayo, 19. ix. 1909 and 23. ix. 1910 (*E. C. Chubb*); 2 ♀, Morogoro, Tanganyika, 16. v. 1922 (*A. H. Ritchie*); 2 ♂, Weenen, Natal, x. 1924 (*H. P. Thomas*).

Mr. Munro notes that the larva of one of the specimens was found feeding on termites in a fungus-garden. Mr. Chubb notes that the species makes a loud buzzing sound, and he also took a specimen on *Marula*-bloom.

Hoplacephala nigriventris, Villeneuve.*Hoplocephala nigriventris*, Villeneuve, Rev. Zool. Afr. iii. p. 108 (1913).

Originally described from the Belgian Congo. Not seen.

Hoplacephala inermis, Villeneuve.*Hoplocephala inermis*, Villeneuve, Rev. Zool. Afr. iii. p. 108 (1913).

♂, Stanleyville, Congo, iii. 1915.

Hoplacephala lateralis, sp. n.

Black, the scutellum and abdomen partly reddish.

Length 10 mm.

Male.—Head with rather dense yellowish-grey pollen, that on the parafacials partly pale brownish, the upper part of the parafrontals more than half shining, with thin brown pollen. Hair fairly long, fine and abundant. Front with four pairs of bristles on the lowest third; four pairs of long orbitals on median third; ocellars absent; a pair of long verticals. Cheeks barely half as wide as eye-height. Palpi black. Antennæ black, the second segment largely reddish brown, the third segment but little longer than the second and hardly as wide; arista short, pubescent. Eyes cinereous yellow, pilose.

Mesonotum dull black, from frontal view moderately brown-pollinose, with the anterior border broadly pale, subshining from posterior view; notopleura and pleura greyish pollinose. Hair black, fairly long, moderately abundant. Acrostichals 0—1; dorso-centrals 2—3; sterno-pleurals 2—1—1; three pairs of marginal scutellars, the apical pair cruciate, and a pair of long fine discals. Free border of scutellum broadly reddish and thickly whitish pollinose.

Legs black; pulvilli short; middle tibiæ with three antero-dorsal bristles on basal half.

Wings cinereous hyaline; ultimate section of fifth vein more than half as long as preceding section; posterior cross-vein oblique, curved; third vein with three or four setæ basally. Squamæ tinged with brownish yellow. Halteres reddish.

Abdomen reddish, the first segment, except the posterior border laterally and ventrally, dull black, the second and third segments with a very broad, tapering, median, opaque black vitta which is narrowly interrupted between the two segments, the black on the second segment occupying more than half the dorsum; fourth segment with a slender median black vitta. Venter with a broad median and broad black lateral vittæ, the latter interrupted at the sutures and shining. Red portions of the abdomen rather thickly yellowish-cinereous pollinose. Hair coarse, appressed, erect on the fourth segment; third segment with a row of marginals, the fourth with a row of much finer ones. Genitalia dull black.

Type, ♂, S. Masai Reserve, Kenya, 10. v. 1912 (*T. J. Anderson*), in British Museum.

Hoplacephala rufiventris, Macquart.

Dichaetometopia rufiventris, Macquart, Dipt. Exot., Suppl. v. p. 127, pl. vi. figs. 1, 1 a (1856).

♂, Kabele, Br. East Africa, 23. xii. 1918 (*T. J. Anderson*); 2 ♀, Ngare Narok, Masai Reserve, Kenya, 31. xii. 1913, about 6000 ft. (*A. O. Luckman*); ♂, S.E. edge of Kenya Forest, 5000–6000 ft., 7. ii. 1911 (*T. J. Anderson*); ♂, St. Madac Reserve, Kenya, 16. v. 1913 (*Anderson*); 2 ♀, Marsabit, Kenya, 26. ix., 7. x. (*G. Chell*).

The specimens recorded above may not be the species described by Macquart, since his figure would appear to show six or seven pairs of frontal bristles forming a complete row. However, the mostly reddish first abdominal segment is an important character in limiting the species, and few of them possess this coloration. Macquart figures no ocellars, but

very long verticals, which also further limits the species. If Macquart's figure of the wing is correct I have incorrectly determined my specimens, since he shows the apical cell ending moderately close to the apex of the wing.

Hoplcephala tessellata, Macquart.

Diptera Exotica, Suppl. i. p. 156 (1846).

♂, Stella Bush, Durban, 29. xii. 1915 (*A. J. T. Janse*);
♂, Durban, Natal, 20. v. 1916 (*E. C. Chubb*),

The frontal bristles are as described and figured by Macquart, although the long bristles are too coarse in his figure. One might well be doubtful about the presence of such remarkable bristles, which are situated at the middle of the front, unless they were actually seen. Macquart's specimen was a male, not female, as stated.

Hoplcephala retroseta, Villeneuve.

Hoplcephala retroseta, Villeneuve, Rev. Zool. Afr. iii. p. 108 (1913).

9 ♂, Pretoria, i., iii., v., vi., viii., ix., xii. (*H. K. Munro*);
1 ♂, Pretoria, 2. iv. 1926 (*Munro*); 1 ♂, Grootvlei, 9. xii. 1914.

This species bears a single strong, isolated, reclinate bristle at the middle of the front.

Hoplcephala stannusi, sp. n.

Black, the scutellum and abdomen largely reddish.

Length 11.5 mm.

Male.—Head brown pollinose, the occiput above, parafrontals, and parafacials, except inwardly, appearing bare from most views. Hair abundant, long; no strong setæ on the face. Seven to nine pairs of fine frontals limited to the lowest three-fourths, the upper two or three pairs reclinate; four pairs of long, fine, orbitals; ocellars absent; verticals moderately long. Cheeks half as wide as eye-height. Palpi and antennæ blackish; arista pubescent. Eyes with reddish-brown pile.

Thorax subopaque, black, the pleura moderately brown pollinose. Hair long and abundant, less dense on the mesonotum. Scutellum more than half reddish and whitish pollinose. Acrostichals 0—1; dorso-centrals 2—3; sternopleurals 2—1—1; three pairs of marginal scutellars, the apical pair cruciate, and a pair of discals. Bristles all long and fine.

Legs black; pulvilli small; middle tibiæ with four to six antero-dorsal bristles on the basal half.

Wings cinereous hyaline; third vein setulose halfway to the small cross-vein; ultimate section of fifth vein much less than half as long as preceding section; posterior cross-vein oblique. Squamæ milky white, with pale yellow border. Halteres brownish red.

Abdomen reddish, the first segment almost wholly and a broad median vitta opaque black. The black on the second segment forms a transverse oval spot, and on the following segments the vitta is less than half as wide as long. Ventrally there is a broad median black vitta and a black spot on either side of the fourth segment. The pollen is cinereous white and covers all the reddish part except a row of large spots just beneath the lateral margins. Second segment with one or two pairs of strong marginals, the third and fourth each with a row; hair appressed except on the fourth segment. Genitalia dull black.

Type, ♂, Zomba, Nyasaland (*H. S. Stannus*), in British Museum.

Hoplcephala irvingi, sp. n.

Belongs to the subgenus *Hoplcephalina*, Villeneuve, and is distinguished from the other two species in the group by the largely reddish abdomen of the male.

Length 10–11 mm.

Male.—Head black, the soft parts of the face and the depression brownish red. Head rather thinly grey pollinose, the parafrontals shining black in some views, the pollen dense and with brassy-yellow tinge along the posterior orbits. Hair of the face and front abundant, although it becomes rather thin above, the row of setæ on the face rather weak; about eight pairs of almost equally strong, almost equally spaced frontals, the upper two or three pairs reclinate; five to seven pairs of proclinate orbitals; ocellars and outer verticals absent. Cheeks hardly half as wide as eye-height. Palpi black. Second antennal segment reddish, the third brown; arista brown, short pubescent. Pile of eyes with yellowish tinge.

Thorax cinereous pollinose, with four black vittæ, the median pair replaced on the posterior half by a single vitta which extends almost to the apex of the scutellum. Acrostichals 0—1; dorso-centrals 2—3; sterno-pleurals 2—1—1; three pairs of marginal scutellars, the apical pair cruciate, and a pair of weak discals. Apical third of the scutellum reddish.

Legs black; pulvilli short; middle tibiæ with three or four antero-dorsal bristles on the basal half, the basal one or two rather weak.

Wings cinereous hyaline: third vein bristled halfway to small cross-vein. Squamæ white, with yellow border. Halteres reddish.

Abdomen reddish, the first and fourth segments, a broad median vitta, and a shining spot towards either side of each segment black, while ventrally there is a broad median vitta and a broad shining black vitta just inside the lateral margins. The abdomen bears cinereous pollen, which leaves the rather small shining black spots and more or less distinct, paired, closely approximate triangles on the second and third segments bare. Hair coarse and appressed, erect on the fourth segment. Third segment with a row of strong marginals, the fourth with weak ones.

Female.—Hair of head short, coarse, not abundant, the inner row of setæ on the face not strong; ocellars fairly strong; outer verticals three-fifths as long as verticals. The mesonotum bears two rusty-brown vittæ on the posterior half lying just outside the median dark vitta. Squamæ without conspicuous yellow rim. Abdomen wholly black, greyish and greyish-brown pollinose, the shining spots transverse, small, the median ones fused to form transverse spots. Each segment below bears a shining area about halfway between the middle and sides on the posterior half and a brownish pollinose sublateral vitta. The marginals on the fourth segment are as strong as those on the third.

Type, ♂, Vryburg, 4. ix. 1920 (*H. E. Irving*); *allotype*, ♀, Pretoria, 15. ii. 1913 (*H. K. Munro*), in Munro Collection; *paratype*, ♂, Vryburg, 8. ix. 1920 (*Irving*).

Hoplacephala maculosa, Villeneuve.

Hoplocephala (Hoplocephalina) maculosa, Villeneuve, Ann. S. Afr. Mus. xv. p. 510 (1916).

♂, New Hanover, Natal, 1. xi. 1913 (*C. B. Hardenberg*); ♀, Uitenhage, 11. iii. 1919 (*H. K. Munro*); ♂, Stella Bush, Durban, 15. iv. 1915 (*Marley*).

Hoplacephala pubera, Villeneuve.

Hoplocephala maculosa pubera, Villeneuve, Ann. S. Afr. Mus. xv. p. 511 (1916).

I do not altogether understand Villeneuve's description of this species, since he does not make it plain whether he is

describing a bare-eyed species or not. However, I conclude that he is, and therefore consider that the male mentioned, from Entebbe, Uganda (*C. C. Gowdey*), is the type of this species.

Hoplcephala arachnoidea, Jænnicke.

Nemeræa? *arachnoidea*, Jænnicke, *Neue Exot. Dipt.* p. 77, pl. ii. fig. 7 (1867).

Bezzi has placed this species as a synonym of *tessellata*, Macq., but he is evidently wrong in doing so, since the isolated pair of frontals, as figured by Jænnicke, is much shorter and finer than in *tessellata*, but this character may not be accurately portrayed, although one should consider it so. However, Jænnicke does not show any vertical bristles, and if these are normally absent his species is very distinct from any so far described; but the probability is that they were broken off. It seems to be closest to *retroseta*, Villeneuve, and was discussed in connection with the description of that species.

Lamprometopia caffra, Macquart.

Lamprometopia caffra, Macquart, *Dipt. Exotica*, Suppl. i. p. 159 (1846).

♂, Port Shepstone, 21. viii. 1920; 1 ♀, Barberton, 5. v. 1913 (*H. K. Munro*).

LVII.—*A Catalogue of the British Eriophyidæ.* By R. S. BAGNALL, F.R.S.E., and Prof. J. W. H. HARRISON, D.Sc., F.R.S.

THE Eriophyidæ, more familiarly known as gall-mites, have, until recently, been more or less neglected in this country, not because of their lack of interest, but because of the comparative absence of literature on the subject.

Even abroad, it is only within the past forty years that they have been subjected to any intensive systematic study and then chiefly by one worker, Nalepa, of Vienna, whose labours, however, have been so exceptionally fruitful that the European species are now reasonably well understood.

Unfortunately, Nalepa's original papers are more or less scattered in various publications, and consequently difficult of access; but in 'Das Tierreich'* he has published a

* Nalepa, "Eriophyidæ (Phytoptidæ)" in 'Das Tierreich.' Berlin, 1898. Lieferung 4.

complete account of all the forms known to him at the date of publication, which he has brought up to date and amplified so far as the German fauna is concerned in Rübsaamen's * monumental work on the German Zooecidia. Further, in the same publication, von Schlechtendal † has supplied the necessary complementary work describing the gall-structures produced on the host-plants when parasitised by Eriophyids. These are referred to as "Nal." and "Nal. 2," respectively, in the body of the catalogue.

Similarly, Houard, in his masterly work ‡ on the European Zooecidia, has dealt with the gall-making forms and their commensals, and this work is indispensable to any serious worker on the group. He supplies references to previous literature and, in addition, furnishes copious figures of the gall-structures.

In English the only books of reference available are the cecidological works of Connold § and of Swanton ||. As our researches have more than doubled the number of species recorded for this country, and as our labours commenced after the appearance of these works, it will be seen how utterly inadequate they are from the standpoint of the serious worker. Hence, to assist future investigators in the group, and to stimulate investigations, we not only put forward this list as a catalogue of British Eriophyidæ known up to the moment of writing, but add references to Nalepa's works above cited and to Houard and Swanton, denoting the latter by the letters H. and S. respectively, with the number of the gall following.

In doing so, we realise that we are laying ourselves open to criticism by encouraging reference to books relying on gall-structures alone for identification. But in this matter we are unrepentant. So minute are the creatures with which we are concerned that no features leading to their correct determination can be lightly cast aside. Even critics of determinations so made, in their unguarded moments, admit that they assign the bulk of their specimens to their correct specific positions on a gall and host plant basis: and at best employ the characters afforded by the

* Rübsaamen, 'Die Zooecidien, durch Tiere erzeugte Pflanzengallen Deutschlands und ihre Bewohner.' Erste Lieferung, Alfred Nalepa, Eriophyiden (Gallenmilben) (1911).

† Zweite Lieferung, D. H. R. v. Schlechtendal, 'Eriophyidoecidien, die durch Gallmilben verursachten Pflanzengallen.' Stuttgart (1916).

‡ Houard, 'Les Zooecidies des Plantes d'Europe.' Paris (1909).

§ Connold, 'British Vegetable Galls.' London (1901).

|| Swanton, 'British Plant Galls.' London (1912).

animals themselves only after the preliminary examination indicated has supplied the correct names.

And why should it be otherwise? The mite itself is so small that acceptable and constant structures of specific value are hard to discover and then to appreciate.

Just as in measuring the expansion of metals use is made of an exaggerated transmission of the expansion to a recording pointer, so we recognise in a gall a magnified result, registered in the tissues of the host-plant, of the chemical interactions between the mite and its food-plant. If the differences between Eriophyid mite species are ultimately chemical in their nature then in this interaction we have a measure, and a very tangible one, of these differences, not distinct in its origin, if in degree, from those extracted from the morphological features of the mite itself. Nevertheless, whilst freely admitting that we attach great importance to host-plant and gall-structures, it is not to be assumed that we have failed in our work to take account of the structure of the animals. Whenever we have deemed it necessary the mites have been examined microscopically, and when such has been the case we have discovered no reasons for altering views formed from the standpoint of other and, in our opinion, satisfactory criteria.

Of course, we fully recognise that free-living Eriophyidæ produce no galls; then, naturally, unless the food or other salient habit affords a short cut to identification, recourse must be made to morphological distinctions exhibited by the mites, and to those alone.

Throughout the list we have included reference to food-plants and to commensals, and in the former connection it should be noted that if a sequence of species or forms occurs in which no food-plant is named, the food-plant is to be understood as being that supplied in case of the species which follows next in order. So, too, we have considered it necessary to include named forms, such as *Eriophyes tiliarus*, known from their gall-structures alone, though we have ignored unnamed species of which the galls alone are described, and which, with unnamed galls of other causers, will form the subject of another memoir.

In the near future, in collaboration with Mr. A. W. Bartlett, M.A., B.Sc., we hope to produce a Monograph on British Cecidology, which we hope will take a place in Britain comparable with that attained by the works of Houard and Ross abroad, and in which the indications of this list will be amplified.

It only remains for us to add that our aim throughout

has been to provide a catalogue whereby users may expedite identifications by quick and ready references to the literature upon which reliance must be made.

Genus *ERIOPHYTES*, Sieb., em. Nal.

- *1. *E. pteridis*, Moll. H. 66.

On *Pteris aquilina*, L.

2. *E. pini* (Nal.). Nal., p. 6; Nal. 2, p. 211; H. 74; S. 23.

On *Pinus silvestris*, L.

- *3. *E. pini*, var. *floricolus*, Nal. Nal. 2, p. 211; H. 112.

On *Abies pectinata*, DC.

- *4. *E. quadrisetus* (F. Thom.). Nal., p. 6; Nal. 2, p. 212; H. 123.

- *5. *E. quadrisetus*, var. *juniperina*, Nal. H. 124.

On *Juniperus communis*, L.

- *6. *E. laricis* (Tubef). Nal., p. 7; Nal. 2, p. 212; H. 87.

On *Larix decidua*, Mill. = *E. pini*, var. *laricis*, Nal.

7. *E. psilaspis* (Nal.). Nal., p. 6; H. 153; S. 16; Nal. 2, p. 212.

On *Taxus baccata*, L. Commensal: *Epitrimerus gemmicola*, Nal.

- *8. *E. tenuis* (Nal.). Nal., p. 7; Nal. 2, p. 213; Houard, various numbers.

On various grasses, *Avena*, *Bromus*, *Dactylis*, and *Holcus*, sometimes accompanied by *Phylloctes dubius* (Nal.).

- *9. *E. cornutus*, Lindr. Nal. 2, p. 213; Houard.

On *Agropyrum* spp.

10. *E. nalepai* (Fockeu). Nal., p. 7; Nal. 2, p. 26; H. 1132; S. 206.

11. *E. laevis* (Nal.). Nal., p. 7; Nal. 2, p. 214; H. 1128; S. 205.

Both on *Alnus rotundifolia*, Mill. (*glutinosa*, Gaertn.).

12. *E. brevitarsus* (Fockeu). Nal., p. 8; Nal. 2, p. 214; H. 1133; S. 204.

On *Alnus rotundifolia*, Mill. Commensal: *Epitrimerus*

longitarsus, Nal. Other Eriophyids attached to this tree are *Oxypleurites heptacanthus*, Nal., *O. trouessarti*, Nal., and *Epitrimerus trinotus*, Nal.

13. *E. rudis* (Can.). Nal., p. 8; Nal. 2, p. 214; H. 1085; S. 197.

*14. *E. rudis*, var. *calycothirus*, Nal. Nal. 2, p. 215; H. 1072 and S. 196.

15. *E. rudis*, var. *longisetosus* (Nal.). Nal., p. 8; Nal. 2, p. 215; H. 1083, 1084; S. 198.

*16. *E. betulæ* (Nal.). Nal., p. 9; Nal. 2, p. 215; H. 1080.

17. *E. lionotus* (Nal.). Nal., p. 9; Nal. 2, p. 215; H. 1081; S. 195.

On *Betula alba*, L., and *B. pubescens*, Ehr. *Epitrimerus acromius*, Nal., is a commensal with *E. betulæ*.

18. *E. macrotrichus* (Nal.). Nal., p. 9; Nal. 2, p. 216; H. 1046; S. 213.

On *Carpinus betulus*, L., accompanied by *Phyllocoptes carpini*, Nal.

19. *E. tenellus* (Nal.). Nal., p. 9; Nal. 2, p. 216; H. 1042; S. 212.

On *Carpinus betulus*, L., accompanied by *Phyllocoptes compressus*, Nal. *Phyllocoptes comatus betuli* is also associated with the plant, causing leaf-browning.

20. *E. avellanæ* (Nal.). Nal., p. 9; Nal. 2, p. 216; H. 1056; S. 218.

On *Corylus avellana*, L. With *Eriophyes vermiformis* and *Anthocoptes loricatus*, Nal.

*21. *E. vermiformis* (Nal.). Nal., p. 10; Nal. 2, p. 217; H. 1055.

On *Corylus avellana*, L.

22. *E. stenaspis* (Nal.). Nal., p. 10; Nal. 2, p. 217; H. 1160; S. 296.

*23. *E. stenaspis*, var. *plicator*, Nal. H. 1159; S. 297.

*24. *E. nervisequus* (Can.). Nal., p. 10; Nal. 2, p. 217; H. 1165.

25. *E. nervisequus*, var. *maculifer*, Trotter. H. 1164; S. 295.

On *Fagus sylvatica*, L.

26. *E. quercinus* (Can.). Nal., p. 11; Nal. 2, p. 217; H. 1818; S. 281.

On *Quercus robur*, L.

- *27. *E. ilicis* (Can.). Nal., p. 11 ; H. 1544.

On *Quercus ilex*, L.

- *28. *E. cerreus*, Nal. Nal. 2, p. 218 ; H. 1863.

On *Quercus cerris*, L. Accompanied by *E. tristernalis*, Nal., but in smaller numbers.

29. *E. tristriatus*, var. *erinea*, Nal. Nal., p. 12 ; Nal. 2, p. 219 ; H. 462 ; S. 84.

On *Juglans regia*, L. The type-species causes a different type of gall, whilst *Phyllocoptes unguiculatus*, Nal., causes leaf-browning on this host-plant.

- *30. *E. populi* (Nal.). Nal., p. 12 ; Nal. 2, p. 219 ; H. 472.

On *Populus alba*, L. Commensal: *Phyllocoptes reticulatus*, Nal.

31. *E. diversipunctatus* (Nal.). Nal., p. 12 ; Nal. 2, p. 219 ; H. 499 ; S. 177.

32. *E. dispar* (Nal.). Nal., p. 12 ; Nal. 2, p. 219 ; H. 486 ; S. 176.

- *33. *E. varius* (Nal.). Nal., p. 12 ; Nal. 2, p. 220 ; H. 575.

On *Populus tremula*, L. *Phyllocoptes ægirinus*, Nal., and *Ph. populi* are also associated with this host-plant.

34. *E. salicinus* (Nal.) (= *salicis*, Nal., non Murray). Nal., p. 13 ; Nal. 2, p. 220.

35. *E. tetanothrix* (Nal.). Nal., p. 13 ; Nal. 2, p. 220.

- 35 a. *E. tetanothrix*, var. *lævis*, Nal. Nal. 2, p. 221.

- *36. *E. triradiatus* (Nal.). Nal. p. 13 ; Nal. 2, p. 221.

On *Salix* spp.

- *37. *E. truncatus*, Nal. Nal., p. 13 ; Nal. 2, p. 221 ; H. 700.

On *Salix purpurea*, L.

- *38. *E. gemmarum* (Nal.). Nal., p. 14 ; Nal. 2, p. 221 ; H. 830.

On *Salix aurita*, L.

- *39. *E. effusus* (Can.). Nal., p. 14 ; Nal. 2, p. 222.

On *Salix caprea*, L. "*Erineum*" as described by Houard from *S. daphnoides* ; the identity of the mite requires confirmation.

The following species have been met with in galled *Salix* catkins :—*E. triradiatus*, *E. salicis*, *Phyllocoptes parvus*, *P. magnirostris*, *P. phytoptoides*, *P. phyllocoptoides*, and *Epitrimerus salicobius*.

- *40. *E. filiformis* (Nal.). Nal., p. 14; Nal. 2, p. 222; H. 2047.

On *Ulmus campestris*, L. Commensal: *Phyllocoptes mastigophorus*, Nal.

41. *E. ulmicola* (Nal.). Nal., p. 14; Nal. 2, p. 222; H. 2053; S. 309.

On *Ulmus campestris*, L. = *E. ulmi*, Nal., non Garman.

- *42. *E. brevipunctatus* (Nal.). Nal., p. 15; Nal. 2, p. 223.

On *Ulmus montana*, With. On *U. pedunculata* this species is accompanied by *E. multistriatus*, Nal., and *Antho-coptes galeatus*, Nal.

- *43. *E. brevipes*, Nal. H. 2230.

On *Atriplex portulacoides*, L.

- *44. *E. salicorniæ*, Nal. H. 2236.

On *Salicornia fruticosa*, L. *E. syriacus* (Fockeu) is also described from this plant.

- *45. *E. cerastii* (Nal.). Nal., p. 16; Nal. 2, p. 224; H. 2337.

On *Cerastium vulgatum*, L.

- *46. *E. atrichus* (Nal.). Nal., p. 16; Nal. 2, p. 223; H. 2321 and 6637.

On *Stellaria graminea*, L., and once on *S. holostea*, L.

- *47. *E. malpighianus* (Cau. et Mass.). Nal., p. 16; Nal. 2, p. 224; H. 2469.

On *Laurus nobilis*, L.

48. *E. congranulatus*, Nal. Nal., p. 16; Nal. 2, p. 224; H. 2466.

On *Berberis vulgaris*, L., causing leaf-browning.

- *49. *E. vitalbæ* (Can.). Nal., p. 17. H. 2413.

On *Clematis vitalba*, L.

- *50. *E. drabæ* (Nal.). Nal., p. 17; Nal. 2, p. 224.

On *Cardamine*, *Draba*, *Capsella*, and *Sisymbrium*.

- 50 a. *E. violæ*, Nal. Nal., see No. 156.

- *51. *E. rosalia* (Nal.). Nal., p. 17; Nal. 2, p. 225; H. 4268.

On *Helianthemum Chamæcistus*, Mill.

52. *E. tiliæ* (Pgst.), Nal. Nal., p. 18; Nal. 2, p. 225; H. 4162; S. 622.

*53. *E. tiliæ liosoma* (Nal.). Nal., p. 18; Nal. 2, p. 226.

*54. *E. tiliæ exilis* (Nal.). Nal., p. 18; Nal. 2, p. 226.

55. *E. tetratrichus* (Nal.). Nal., p. 18; Nal. 2, p. 226; H. 4159; S. 621.

56. *E. tiliarius* (Murray), Con. H. 4132; S. 620.

On *Tilia* spp.

*57. *E. geranii* (Can.). Nal., p. 18; Nal. 2, p. 226; H. 3801.

*58. *E. dolichosoma* (Can.). Nal., p. 19; Nal. 2, p. 227; H. 3802.

On *Geranium sanguineum*, L.

*59. *E. schlechtendali* (Nal.). Nal., p. 19; Nal. 2, p. 227; H. 3825.

On *Erodium cicutarium*, l'Hérit.

*60. *E. hippocastani* (Fockeu). Nal., p. 19; Nal. 2, p. 227; H. 4049.

On *Æsculus hippocastanum*, L.

61. *E. macrorhynchus* (Nal.). Nal., p. 20; Nal. 2, p. 228; H. var. nos.; S. 603 and 609.

On *Acer pseudoplatanus*, L., and *A. campestre*, L.

*62. *E. heteronyx* (Nal.). Nal., p. 19; Nal. 2, p. 228; H. 4012.

On *Acer campestre*, L.

63. *E. macrochelus* (Nal.). Nal., p. 20; Nal. 2, p. 228; H. var. nos.; S. 604, 608.

*64. *E. macrochelus*, var. *erinea*, Trotter. H. 3974, 4021.

On *Acer pseudoplatanus*, L., and *A. campestre*, L.

*65. *E. pseudoplatani*, Corti. Nal. 2, p. 229; H. 3977.

On *Acer pseudoplatanus*, L.

*66. *E. macrochelus megalonyx*, Nal. Nal. 2, p. 229; H. 4017.

*67. *E. macrochelus carinifex*, Kieff. H. 4023; ?=No. 68.

*68. *E. macrochelus crassipunctatus*, Nal. Nal. 2, p. 229; H. 4023.

On *Acer campestre*, L.

*69. *E. brevirostris* (Nal.). Nal., p. 20; Nal. 2, p. 229.

On *Polygala* spp.

- *70. *E. convolvens* (Nal.). Nal., p. 20; Nal. 2, p. 230; H. 3960.

On *Euonymus europæus*, L.

- *71. *E. annulatus*, Nal. Nal., p. 21; Nal. 2, p. 231; H. 4071.

On *Rhamnus cathartica*, L.

- *72. *E. euphorbiæ* (Nal.). Nal., p. 21; Nal. 2, p. 231.

On *Euphorbia paralias*; gall similar to that of *E. euphorbiæ* on *E. cyparissias*. See H. 3886.

- *73. *E. canestrinii* (Nal.). Nal., p. 22; Nal. 2, p. 231; H. 3907.

On *Buxus sempervirens*, L.

- *74. *E. empetri*, Lindroth. H. 3906.

On *Empetrum nigrum*, L.

- *75. *E. oxalidis*, Trotter. Nal. 2, p. 227; H. 3832.

On *Oxalis*.

- *76. *E. peucedani* (Can.). Nal., p. 23; Nal. 2, p. 231; H. 4447.

On *Pimpinella saxifraga*, L.

77. *E. pimpinellæ*, Connold. ? H. 4449; S. 659.

On *Pimpinella saxifraga*, L., a very distinctive gall.

- *78. *E. rhodiolæ* (Can.). Nal., p. 23; Nal. 2, p. 232; H. 2747/8.

On *Sedum rhodiola*, DC. (*Rhodiola rosea*, L.).

The gall was well described by Trail, but overlooked by Houard etc.

- *79. *E. destructor* (Nal.). Nal., p. 23; Nal. 2, p. 232; H. 2756.

On *Sedum acre*, L.

80. *E. ribis* (Nal.). Nal., p. 24; Nal. 2, p. 233; H. 2807, 2798; S. 451, 454.

On *Ribes rubrum* and *nigrum*. The big bud of our gardens.

- *81. *E. kochi* (Nal. & F. Thom.). Nal., p. 24; Nal. 2, p. 233; H. 2776.

On *Saxifraga aizoides*, L., and apparently on *S. hypnoides*. Also well described by Trail.

- *82. *E. hippophænus*, Nal. Nal., p. 25; Nal. 2, p. 234;
H. 4318.

On *Hippophaë rhamnoides*, L.

This is the *E. nalepai* of Nalepa and Trouessart (1890), *non* Fockeu 1890!

83. *E. piri* (Pgst.), Nal. Nal., p. 25; Nal. 2, p. 234.

On *Pyrus communis*, L.; *P. malus*, L.; *P. aucuparia*, L.;
P. torminalis, Crantz; *P. aria*, Ehrh., etc.

84. *P. piri*, var. *variolata* (Nal.). Nal., p. 25; Nal. 2, p. 234.

On *Pyrus* spp.

85. *E. malinus* (Nal.). Nal. p. 26; Nal. 2, p. 235;
H. 2892; S. 538.

On *Pyrus malus*, L.

86. *E. crategi* (Can.). Nal. p. 26; H. 2950; S. 543;
also H. 2944.

- *87. *E. calycobius* (Nal.). Nal. p. 26; Nal. 2, p. 235;
H. 2943.

. This and the preceding are accompanied in the bud-gall by
Epitrimerus armatus, Nal.

- *88. *E. albæspinæ*, Cotte. H. 6757.

89. *E. goniothorax* (Nal.). Nal. p. 27; Nal. 2, p. 235;
H. 2948; S. 544.

On *Cratægus oxyacantha*, L.

- *90. *E. parvulus* (Nal.). Nal. p. 27; Nal. 2, p. 236;
H. 3062.

On *Potentilla reptans*, L.

- *91. *E. nudus* (Nal.). Nal. p. 27; Nal. 2, p. 236;
H. 3088.

On *Geum urbanum*, L.

92. *E. gibbosus* (Nal.). Nal. p. 28; Nal. 2, p. 236;
H. 2982; S. 484.

On *Rubus fruticosus* (Agg.).

- *93. *E. rubicolens* (Can.). Nal. p. 28; H. 3027.

- *94. *E. gracilis* (Nal.). Nal. p. 28; Nal. 2, p. 226;
H. 2967, 3026.

• On *Rubus idæus*, L., and *Rubus cæsius*, L.

- *95. *E. silvicola* (Can.). Nal. p. 28 ; Nal. 2, p. 237 ;
H. 3031.

On *Rubus saxatilis*, L.

96. *E. sanguisorbæ* (Can.). Nal. p. 28 ; Nal. 2, p. 237 ;
H. 3103 ; S. 496.

On *Poterium sanguisorba*, L.

97. *E. rosæ*, Swanton. H. 3114 ; S. 517.

On *Rosa arvensis*, Hudson.

- *98. *E. phlæcoptes* (Nal.). Nal. p. 29 ; Nal. 2, p. 237 ;
H. 3271.

On *Prunus domestica*, L.

99. *E. similis* (Nal.). Nal. p. 29 ; Nal. 2, p. 237 ;
H. 3284, 3265 ; S. 460, 464.

On *Prunus spinosa*, L., and *P. institia*, L.

100. *E. padi* (Nal.). Nal. p. 29 ; Nal. 2, p. 237 ; H. 3314 ;
S. 470.

- *101. *E. paderineus*, Nal. Nal. 2, p. 238 ; H. 3315.

On *Prunus padus*, L.

- *102. *E. genistæ* (Nal.). Nal. p. 30 ; Nal. 2, p. 239 ;
H. 3419, 3398.

On *Ulex* and *Sarothamnus*.

- *103. *E. euaspis* (Nal.). Nal. p. 31 ; Nal. 2, p. 239 ;
H. 3615, 3620, and 3629.

On *Lotus* spp.

- *104. *E. plicator* (Nal.). Nal. p. 31 ; Nal. 2, p. 239 ;
H. 3508.

On *Medicago lupulina*, L.

- *105. *E. plicator trifolii* (Nal.). Nal. p. 31 ; Nal. 2,
p. 239 ; H. 3572, 3588.

On *Trifolium arvense*, L., and *T. pratense*, L.

- *106. *E. ononidis* (Can.). Nal. p. 31 ; Nal. 2, p. 240 ;
H. 3499.

On *Ononis repens*, L.

- *107. *E. alpestris* (Nal.). Nal. p. 32 ; Nal. 2, p. 240 ;
H. 4552.

On *Rhododendron ferrugineum*, L. *Phyllocoptes thomasi*
is also recorded from this gall.

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- *108. *E. rübsaameni* (Nal.). Nal. p. 32; Nal. 2, p. 240;
H. 4561.

On *Andromeda polifolia*, L.

109. *E. callunæ*, Swanton = H. 4574; S. 674.

On *Calluna vulgaris*, Salisb.

- *110. *E. lacticinctus* (Nal.). Nal. p. 33; Nal. 2, p. 241;
H. 4617.

E. laccinatus (err. typog.), B. & H.

On *Lysimachia vulgaris*, L.

111. *E. frazini* (Karp.). Nal. p. 33; Nal. 2, p. 241
(=*frazinivorus*); H. 4636; S. 683.

- *112. *E. frazinicola* (Nal.). Nal. p. 33; Nal. 2, p. 241;
H. 4648.

On *Frazinus excelsior*, L. (See also no. 157.)

- *113. *E. kernerii* (Nal.). Nal. p. 34; Nal. 2, p. 242;
H. 4688.

On *Gentiana amarella*, *G. verna*, and *G. campestris*.

- 113 a. *E. convolvuli*, Nal. (See no. 155.)

- *114. *E. eutrichus* (Nal.). Nal. p. 34; Nal. 2, p. 243;
H. 4734.

On *Lycopsis arvensis*, L.

- *115. *E. cladophthirus* (Nal.). Nal. p. 35; Nal. 2, p. 243;
H. 4981.

On *Solanum dulcamara*, L.

- *116. *E. euphrasie* (Nal.). Nal. p. 35; Nal. 2, p. 244;
H. 5120.

On *Euphrasia officinalis*, L.

117. *E. anceps* (Nal.). Nal. p. 35; Nal. 2, p. 243;
H. 5078, 5082, and 5086; S. 729.

On *Veronica chamædrys*, L., and *V. officinalis*, L. Com-
mensal in H. 5082:—*Phyllocoptes latus*, Nal.

118. *E. ajugæ* (Nal.). Nal. p. 35; Nal. 2, p. 246;
H. 4759, 4761; S. 717, 718.

On *Ajuga reptans*, L.

- *119. *E. solidus* (Nal.). Nal. p. 36; Nal. 2, p. 246;
H. 4853.

On *Betonica officinalis*, L., and *Stachys silvatica*, L.

- *120. *E. bartschiæ*, Nal. Nal. 2, p. 244; H. 5127.

On *Bartschia alpina*, L.

- *121. *E. salviæ* (Nal.). Nal. p. 36; Nal. 2, p. 245; H. 4882.

On *Salvia verbenacea*, L. *Phyllocoptes obtusus*, Nal., is recorded as a commensal of this species on *Salvia pratensis*.

- *122. *E. mentharius* (Can.). Nal. p. 36; Nal. 2, p. 244; H. 959.

On *Mentha silvestris*, L.

- *123. *E. megacerus* (Can. et Mass.). Nal. p. 67; Nal. 2, p. 244; H. 4954.

On *Mentha aquatica*, L.

124. *E. thomasi* (Nal.). Nal. p. 37; Nal. 2, p. 245; H. 4920; S. 700, 701.

On *Thymus serpyllum*, L.

- *125. *E. minor*, Nal. Nal. 2, p. 245; H. 4919.

On *Thymus serpyllum*, L.

126. *E. origani* (Nal.). Nal. p. 37; Nal. 2, p. 245; H. 4901; S. 696.

On *Origanum vulgare*, L. = *E. thomasi*, var. *origani*.

- *127. *E. schmardæ* (Nal.). Nal. p. 38; Nal. 2, p. 246; H. 5512.

- *128. *E. campanulæ*, Lindr. Nal. 2, p. 247; H. 5516.

On *Campanula rotundifolia*, L.

129. *E. euanthus*, Nal. Nal. p. 38; Nal. 2, p. 246; H. 5552; S. 791.

On *Jasione montana*, L.

130. *E. galii* (Karp.), Nal. Nal. p. 38; Nal. 2, p. 247; H. 5308, etc.; S. 766.

On *Galium Aparine*, L., *G. verum*, L., *G. palustre*, L., *G. boreale*, L., *G. mollugo*, L., *G. silvaticum*, L., *G. saxatile*, L.

131. *E. galiobius* (Can.). Nal. p. 38; Nal. 2, p. 247; H. 5283, 5256; S. 750, 1, 7.

On *Galium verum*, L., and *G. saxatile*, L. Commensals: *Tegonotus dentatus*, Nal., and *Tarsonemus contubernalis*, Reut.

- *132. *E. rubiæ* (Can.). Nal. p. 39 ; H. 5321.

On *Rubia peregrina*, L. In our opinion the leaf-rolling in this plant is caused by another species of Eriophyid.

- *133. *E. xylostei* (Can.). Nal. p. 39 ; Nal. 2, p. 248 ; H. 5391.

On *Lonicera periclymenum*, L., and *L. japonica*, And.

134. *E. viburni* (Nal.). Nal. p. 39 ; Nal. 2, p. 248 ; H. 5340 and 5350 ; S. 773 and 776.

On *Viburnum Opulus*, L., and *V. lantana*, L.

A commensal, *Phyllocoptes oblongus*, Nal., is commonly found in the gall of this species.

- *135. *E. macrotuberculatus* (Nal.). Nal. p. 39 ; Nal. 2, p. 248 ; H. 5419.

On *Valeriana officinalis*, L.

136. *E. squalidus* (Nal.). Nal. p. 40 ; Nal. 2, p. 248 ; H. 5464 ; S. 790.

On *Scabiosa columbaria*, L.

- *137. *E. kiefferi* (Nal.). Nal. p. 40 ; Nal. 2, p. 250 ; H. 5674.

On *Achillea millefolium*, L.

- *138. *E. artemisiæ* (Can.). Nal. p. 40 ; Nal. 2, p. 249 ; H. 5823.

- *139. *E. marginem-volvens*, Corti (= *E. artemisiæ*, var. *subtilis* (Nal.)). Nal. p. 41 ; Nal. 2, p. 250 ; H. 5820.

On *Artemisia vulgaris*, L.

- *140. *E. tenuirostris* (Nal.). Nal. p. 41 ; Nal. 2, p. 250 ; H. 5768.

On *Artemisia absinthium*, L.

Paraphytoptus paradoxus, Nal., is recorded with this species.

141. *E. centaureæ* (Nal.). Nal. p. 41 ; Nal. 2, p. 251 ; H. 5989 ; S. 860.

On *Centaurea scabiosa*, L.

- *142. *E. dianthæ*, Lindr.

On *Diantha deltoidea*, L.

- *143. *E. sonchi*, Nal.; see H. 6102 on *S. maritimus*.

On *Sonchus oleracea*, L.

- *144. *E. anthocoptes* (Nal.). Nal. p. 42; Nal. 2, p. 252; H. 5926.

On *Cirsium arvense*, Scop.

- *145. *E. puculosus* (Nal.). Nal. p. 42; Nal. 2, p. 249.

On *Erigeron acer*, L.

146. *E. longisetus* (Nal.). Nal. p. 42; Nal. 2, p. 253; H. 6167; S. 867.

On *Hieracium* spp.

- *147. *E. pilosellæ* (Nal.). Nal. p. 43; Nal. 2, p. 253; H. 6202.

On *Hieracium pilosella*, L.

- *148. *E. leontodontis*, Lindr. Nal. 2, p. 252; H. 6059.

On *Leontodon autumnalis*, L.

- *149. *E. hypochærinus* (Nal.). Nal. p. 43; Nal. 2, p. 252; H. 6038.

On *Hypochæris radicata*, L., and *H. glabra*, L.

- *150. *E. rechingeri*, Nal. Nal. 2, p. 253; H. 6127.

On *Crepis biennis*, L.

- *151. *E. lioproctus* (Nal.). Nal. p. 44; Nal. 2, p. 251; H. 5867.

On *Senecio jacobæa*, L., and *S. vulgaris*, L.

- *152. *E. tuberculatum* (Nal.). Nal. p. 44; Nal. 2, p. 250; H. 5756.

On *Tanacetum vulgare*, L.

- *153. *E. cuscutæ*, Moll. H. 7233.

On *Cuscuta epithymum*, Murray.

154. *E. convolvuli*, Nal. Nal. 2, p. 242; H. 4714; S. 688.

On *Convolvulus arvensis*, L. A similar deformation, discoloured, but without abnormal pilosity, is caused by *Phylloctes convolvuli*, Nal.

- *155. *E. tamaricis*, Trotter. H. 4229.

On *Tamarix gallica*, L.

- *156. *E. violæ*, Nal. Nal. 2, p. 225; H. 4294.

On *Viola tricolor*, L., and *V. silvestris*, Lam.

- *157. *E. fraxinivorus*, Nal. Nal. 2, p. 241; see H. 4631.
On *Fraxinus ornus*, L. (See also no. 111.)

Genus MONOCHETUS, Nal.

158. *M. sulcatus* (Nal.). Nal. p. 44; Nal. 2, p. 254
H. 1163; S. 298.
On *Fagus silvatica*, L.

Subfamily PHYLLOCOPTINÆ.

Genus PHYLLOCOPTES, Nal.

- *159. *Ph. dubius* (Nal.). Nal. p. 46; Nal. 2, p. 256.
On *Avena*, *Bromus*, and *Dactylis*.
- *160. *Ph. comatus*, Nal. Nal. p. 46; Nal. 2, p. 256.
On *Corylus avellana*, L., leaf-browning.
- *161. *Ph. comatus betuli*, Nal. Nal. p. 47; Nal. 2, p. 257.
On *Carpinus betulus*, L., leaf-browning.
- *162. *Ph. gracilipes*, Nal. Nal. p. 47; Nal. 2, p. 257.
On *Fagus silvatica*, L., in Erineum, etc.
- *163. *Ph. populi*, Nal. Nal. p. 48; Nal. 2, p. 258.
On *Populus tremula*, L.
- *164. *Ph. magnirostris*, Nal. Nal. 2, p. 258.
Ph. magnirostris, Nal., *Ph. parvus*, Nal., *Ph. phytotooides*,
Nal., and *Ph. phyllocoptoides* (Nal.), are associated with galls
on *Salix* spp. We have seen the first-named with *E. truncatus* on *Salix purpurea*.
- *165. *Ph. gymnaspi*, Nal. Nal. p. 50; Nal. 2, p. 260;
H. 4015.
On *Acer campestre*, L.
- *166. *Ph. aceris*, Nal. Nal. p. 51; Nal. 2, p. 260.
In galls of *Eriophyes macrochelus* and *E. macrorrhynchus*
on *Acer campestre*, L.
167. *Ph. acericola*, Nal. Nal. p. 51; Nal. 2, p. 260;
H. 3975; S. 605.
On *Acer pseudoplatanus*, L.
- *168. *Ph. depressus*, Nal. Nal. p. 51; Nal. 2, p. 261.
On *Cornus sanguinea*, L., leaf-browning.

- *168 a. *Ph. masseei*, Nal. 1925. Marcellia, 21, p. 95.

On *Ribes*.

- *169. *Ph. schlechtendali*, Nal. Nal. p. 52 ; Nal. 2, p. 261 ; A. 2865.

On *Pyrus communis*, L.

- *170. *Ph. fockeui*, Nal. et Trouess. Nal. p. 52 ; Nal. 2, p. 262 ; H. 3972.

On *Prunus domestica*, L.

- *171. *Ph. allotrichus*, Nal. Nal. p. 54 ; Nal. 2, p. 264 ; H. 3637.

- *172. *Ph. robinia*, Nal. Nal. p. 54 ; Nal. 2, p. 264 ; H. 3636.

On *Robinia pseudo-acacia*, L.

- *173. *Ph. retiolatus*, Nal. Nal. p. 54 ; Nal. 2, p. 264 ; H. 3724.

On *Vicia cracca*, L.

174. *Ph. fraxini*, Nal. Nal. p. 55 ; Nal. 2, p. 265 ; H. 4642 ; S. 684.

- *175. *Ph. epiphyllus*, Nal. Nal. p. 55 ; Nal. 2, p. 265 ; H. 4646.

On *Fraxinus excelsior*, L.

176. *Ph. pedicularis*, Nal. Nal. p. 56 ; Nal. 2, p. 276 ; H. 5132-3 ; S. 735.

On *Pedicularis pulustris*, L., and *P. silvatica*, L.

- *177. *Ph. teucarii*, Nal. Nal. p. 56 ; Nal. 2, p. 267 ; H. 4773.

On *Teucrium chamaedrys*, L. *Acanthocoptes octocinctus*, Nal., is a commensal.

- *178. *Ph. scutellariae*, Can. et Massal. Nal. p. 57 ; Nal. 2, p. 267 ; H. 4792.

On *Scutellaria galericulata*, L.

- *179. *Ph. minutus*, Nal. Nal. p. 57 ; Nal. 2, p. 267 ; H. 5786.

On *Asperula cynanchica*, L.

- *180. *Ph. psilocranus*, Nal. Nal. p. 57 ; Nal. 2, p. 268 ; H. 5315.

On *Galium cruciatum*, L.

- *181. *Ph. anthobius*, Nal. Nal. p. 57 ; Nal. 2, p. 268 ;
H. 5241, 5249, and 5282.

On *Galium silvaticum*, *G. saxatile*, and *G. verum*.

- *182. *Ph. oblongus*, Nal. Nal. p. 58 ; Nal. 2, p. 268.

In galls of *Eriophyes viburni* on *Viburnum lantana*, L.

- *183. *Ph. rigidus*, Nal. Nal. p. 58 ; Nal. 2, p. 268 ;
H. 6091.

On *Taraxacum officinale*, Wigg.

Genus ANTHOCOPTES, Nal.

- *184. *A. aspidophorus*, Nal. Nal. p. 60 ; Nal. 2, p. 270 ;
H. 4732.

On *Anchusa officinalis*, L.

Genus TEGONOTUS, Nal.

- *185. *T. fastigatus*, Nal. Nal. p. 61 ; Nal. 2, p. 273.

On *Acer campestre*, L., causing leaf-browning.

- *186. *T. dentatus*, Nal. Nal. p. 61 ; Nal. 2, p. 273.

Inquiline with *Eriophyes galiobus* on *Galium verum*.

Genus EPITRIMERUS, Nal.

- *187. *E. gemmicola*, Nal. Nal. p. 62 ; Nal. 2, p. 274.

Inquiline in galls of *Eriophyes psilaspis* on *Taxus baccata*, L.

- *188. *E. trinotus* (Nal.). Nal. p. 62 ; Nal. 2, p. 274 ;
H. 1131.

On *Alnus rotundifolia*, Mill.

- *189. *E. longitarsus* (Nal.). Nal. p. 62 ; Nal. 2, p. 274.

Inquiline in gall of *Eriophyes brevitaris* on *Alnus rotundifolia*.

- *190. *E. cristatus* (Nal.). Nal. p. 63 ; Nal. 2, p. 275 ;
H. 1308.

- *191. *E. massalongioianus* (Nal.). Nal. p. 63 ; Nal. 2,
p. 275 ; H. 1314.

On *Quercus robur*, L.

- *192. *E. salicobius* (Nal.). Nal. p. 63 ; Nal. 2, p. 275.

On *Salix alba*, L., and *S. fragilis*, L.

- *193. *E. rhynchothrix* (Nal.). Nal. p. 64 ; Nal. 2, p. 276 ; H. 2434.

On *Ranunculus repens*, L.

- *194. *E. armatus* (Can.). Nal. p. 64 ; Nal. 2, p. 277 ; H. 2952.

On *Cratægus oxyacantha*, Jacq.

- *195. *E. coactus* (Nal.). Nal. p. 65 ; Nal. 2, p. 277 ; H. 5155.

On *Plantago lanceolata*, L.

196. *E. trilobus* (Nal.). Nal. p. 65 : Nal. 2, p. 278 ; H. 5333 ; S. 771.

On *Sambucus nigra*, L.

Genus OXYPLEURITES, Nal.

- *197. *O. serratus* (Nal.). Nal. p. 67 ; Nal. 2, p. 272.

On *Acer campestre*, L., leaf-browning, with *Tegonotus fastigatus*.

- *198. *O. carinatus* (Nal.). Nal. p. 67 ; Nal. 2, p. 272.

On *Æsculus hippocastanum*, L., leaf-browning.

Genus CALLYNTROTUS, Nal.

- *199. *C. hystrix*, Nal. Nal. p. 68 ; Nal. 2, p. 278.

On *Triticum repens*, L.

LVIII.—*The Cirripede Chionelasmus* (Pilsbry) and a Discussion of its Phylogeny. By CARL AUG. NILSSON-CANTELL, Fil. Dr., Sweden.

THIS Cirripede was first described by Pilsbry (1907), who later (1911, 1916) regarded it as representing a new subgenus of *Catophragmus*; but the present more complete material serves to show that it should be ranked as a distinct genus.

Genus CHIONELASMUS (Pilsbry, 1911).

Catophragmus, Pilsbry (1907).

Catophragmus (*Chionelasmus*), Pilsbry (1911, 1916).

Diagnosis.—Interior compartments six, all without radii ;

carina, lateralia, and rostrum with alæ, their bases concealed by one exterior whorl of small supplemental compartments. The base is calcareous, but thin. Scutum without an adductor ridge, the articular ridges of both opercular valves strongly developed. Caudal appendages present.

Chionelasmus darwini, Pilsbry (1907). (Figs. 1 & 2.)

Catophragmus darwini, Pilsbry (1907).

Catophragmus (Chionelasmus) darwini, Pilsbry (1911, 1916).

Discussion and description.—One well-preserved specimen taken from a telegraph-cable in the Indian Ocean was found in the collection of the British Museum (Nat. Hist.). Since it represents a new and, in my opinion, primitive Cirripede genus, a discussion of the phylogeny may be of great interest.

It has been already described by Pilsbry (1907) from the Hawaiian Islands, but is known only by mutilated individuals, of which some figures have been given. He had seen all the six plates in the wall, but they came from different individuals. Yet he thinks there is an octomorous wall, as the "median latera" are still unknown. The species is thus placed in the genus *Catophragmus*, which has eight interior compartments and many whorls of supplemental compartments in the wall. As there is only one whorl of supplemental compartments in Pilsbry's specimens, he adds that, when perfect individuals are known, it may be taken up as a distinct genus, or, at least, subgenus, just distinguished by the single series of accessory basal plates and the well-developed caudal appendages. As I have here an individual which shows that the wall has only six plates and one whorl of supplemental compartments, it must be described as a distinct genus, for which the name *Chionelasmus* was proposed by Pilsbry as early as 1911. It is now of great interest to be able to give a complete description.

The *shell* is nearly white, of a porcellanous texture, as Pilsbry states, rather high, with a wide rhombic orifice.

The *scutum* is triangular, externally with riblets parallel to the basal margin, and with longitudinal striæ. The tergal margin has in the upper part a strongly projecting articular ridge. The articular furrow is rather deep. Inside, a distinct furrow is situated in the apical area. No adductor ridge is developed. The scar of the adductor ridge is very indistinct. On the occludent border an inflexed part is seen from the inside with the horizontal and longitudinal striæ well marked.

The *tergum* is also triangular, externally with the same striation as in the scutum. Along the tergal margin externally a broad but shallow furrow is seen. The carinal margin is slightly convex. The spur is not separated from the basiscutal corner. The carinal half of the basal margin a little concave. The articular furrow rather deep, and the articular ridge, about half as long as the scutal margin, projects far on the scutal side. Very small crests for the depressor muscle near the basicarinal corner are seen.

The *carina* is the highest plate in the wall, with an apical umbo like the other plates in the wall. Wide *alæ* are formed. The median part with five ridges as in Pilsbry's individuals. The growth-lines are well marked. The details are to be seen from the figures.

The plates which Pilsbry called the carino-lateral, as he supposed there were eight compartments in the wall, are, in my opinion, the real *latera*. The "median latera" are supposed by Pilsbry to be unknown. Reasons for my opinion will be given later on in the discussion of the phylogeny. These *latera* overlap the *alæ* of the carina, yet radii are not formed. The plate consists externally of a triangular part with five ridges, with the same growth-lines as mentioned for the carina, and at the rostro-lateral side of a very wide *ala* also with growth-lines.

The *rostro-lateral* plate is the smallest of the interior valves, triangular, with five ridges (according to Pilsbry four). The plate covers the nearest plates, but radii are not developed.

The *rostrum* is of the same shape as the carina, with two *alæ*, but is smaller in size. The median triangular part with ribs. Growth-lines over the whole plate.

The *interior side* of the compartments has no ridges and all the valves are solid without pores.

By the base of the wall an *exterior whorl* of small triangular supplemental compartments is situated. As the specimen here studied carried some corals on the wall, it was not possible to see all the plates in this whorl; but I think there are about twenty or rather more. The fact that there is only one row is of considerable interest. Pilsbry (1907) figures four such plates, and adds that they are of three shapes—"doubly winged," "winged on one side," and "without lateral wings." These three types are represented here.

The plates in my specimen could best be studied in the carinal half of the whorl (fig. 19). The plate under the middle rib of the carina had two small radiiform areas. Both plates besides this have one aliform area nearest the middle

Fig. 1.

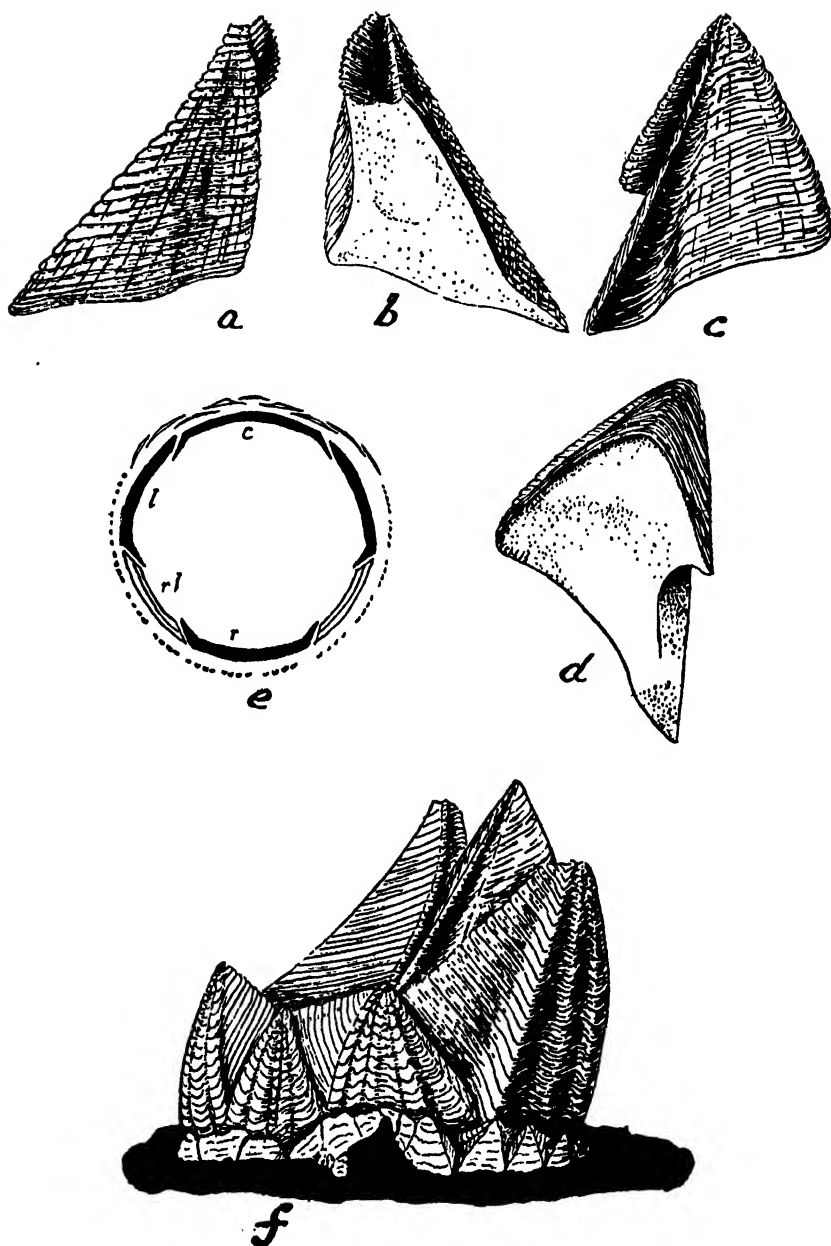
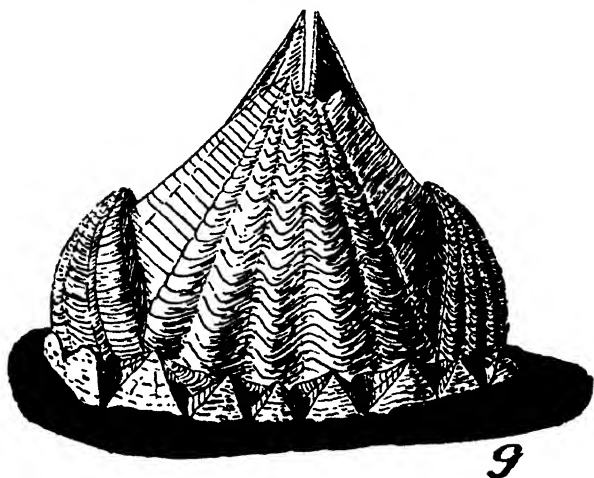


Fig. 1 (cont.).

*Chionelasmus darwini*, Pilsbry (1907).

a, b, left scutum; *c, d*, left tergum; *e*, diagram (*c*, carina; *l*, lateral compartment; *rl*, rostro-lateral compartment; *r*, rostrum); *f*, the specimen, lateral aspect; *g*, carinal aspect.

plate and one radiiform area at the other side. The plates lying nearest to those have two aliform areas. The next plates at both sides have one radiiform and one aliform area. The other plates could not be correctly figured; they are thus only indicated in the figures and the diagram. The plates are a little lower than those figured by Pilsbry, but I think this is not of specific value.

The *base* was not known to Pilsbry. In this specimen the base is very thin. I thought it first to be membranous, but by the use of hydrochloric acid it could be proved that the base was calcified although very thin.

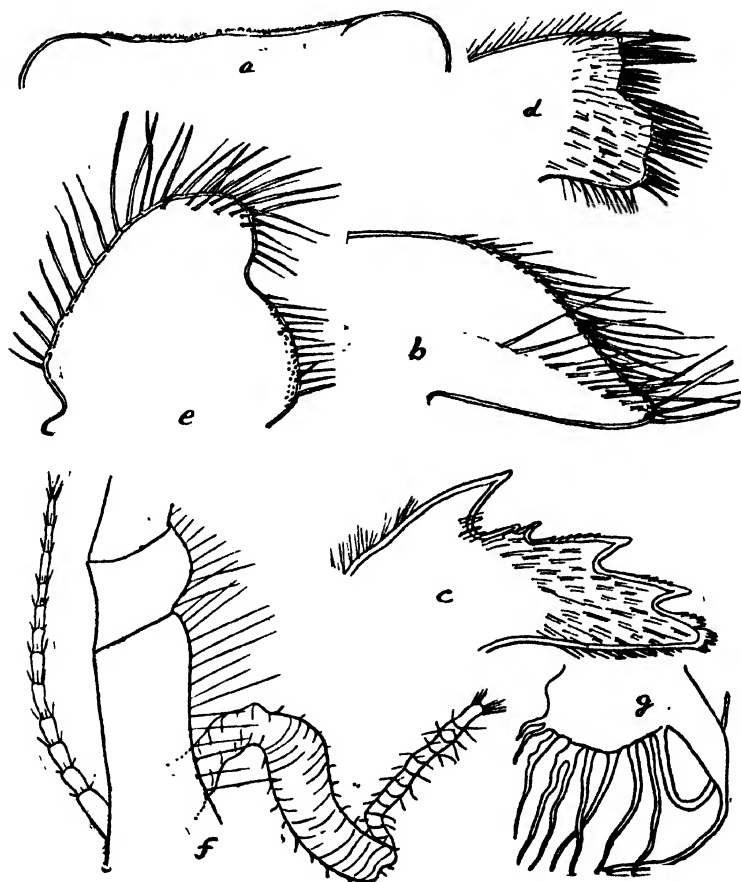
Mouth-parts.—*Labrum* weakly concave, with teeth and hairs. *Palpus* conical, with bristles at the point and edge. Also bristles were found along a middle line from the point on the outside of the palp.

Mandible with three large teeth and a pectinated inner angle. Between tooth 1 and 2 two small additional teeth and some smaller ones are situated. Such smaller teeth are also found on the upper side of tooth 3. Some small variation exists, as Pilsbry figured a mandible without the two above-mentioned additional teeth.

The *maxilla I.* is very like that figured by Pilsbry, with the lower part step-like, projecting. In both parts above there are strong spines followed by smaller ones.

The *maxilla II.* is of the Chthamalid type, with a spineless

Fig. 2.



Chionelasmus darwini, Pilsbry (1907).

a, labrum; *b*, palpus; *c*, mandible; *d*, maxilla I.; *e*, maxilla II.;
f, cirrus VI., caudal appendage, and penis; *g*, branchia.

notch at the middle, thus bilobed. The bristles on the upperside not divided into two groups. In the posterior part a very small maxillary lobe is differentiated.

Measurements (in mm.) :— Carino-rostral length 15 ; height 12.

Number of segments of the cirri :—

	I.	II.	III.	IV.	V.	VI.	Caudal appendage.
	11 13	20 22	22 24	26 27	27 28	28 29	12
After Pilsbry.	{ 10 10	..	21 21	..	25 —	..	13

As seen above, there is much agreement with Pilsbry's specimen. The first cirrus with shorter rami unequal in length. Cirrus VI. with five pairs of spines on the front edge of the segments. The *caudal appendage* is longer than the protopodite of the sixth cirrus. The *penis* is very long, with hairs at the end and along its whole length ; annulated. Pilsbry (1907) says " apparently annulated."

The *branchiæ* have the form of thin folds with long filaments along the margin. There is on the branchia studied one larger and ten smaller filaments varying in length, one of them divided into two.

Old locality.—Hawaiian Islands, vicinity of Kauai, 228 to 235 fathoms.

New locality.—Rodriguez Island, $9\frac{1}{2}$ miles N., 40 miles W. of Port Mathurin, 288 fathoms. U.S. 'Lady Denison Pender.' Presented by Eastern and Associated Telegraph Companies.

Distribution.—As there can be no doubt that this specimen from the Indian Ocean is identical with those described by Pilsbry from the Pacific Ocean, we have here further confirmation of our imperfect knowledge of the deep-sea cirripedes. We must suppose that localities exist in the intervening waters, as, *e. g.*, the Malaysian region, which is held to be a cirripede centre by Broch. He says (1922, p. 354) :—" In these regions the most ancient forms, moreover, have endured up to our day." I believe *Chionelasmus* is such an old form.

DISCUSSION OF THE PHYLOGENY.

As has been already stated, this species is of great interest from the phylogenetic point of view. As, just now, opinions among the cirripede authors are divergent, every contribution may be of value. Much seems to me to speak for the old Darwinian opinion of the recent forms that genera with a greater number of plates are the most ancient and those with a smaller number of valves have generally arisen from the former through elimination or fusion of the plates.

There is no reason to discuss here the question as regards the pedunculate forms, as the whole problem was recently discussed by Withers (1928). In this work he says (p. 46):—"The evidence seems overwhelmingly clear that there has been a reduction from eight compartments to virtually a single shell in the two families of the Balanomorpha." As regards this suborder S. Runnström and Broch have from the ontogeny of some few recent sessile cirripedes drawn the conclusion that genera with a greater number of plates in the wall are developed from those with a smaller. I think more material must be studied before we can conclude that this is valid for all the genera. Broch himself, who has recently (1927) studied a primitive genus *Chthamalus*, cannot in that find as in *Balanus* a tetramerous stage before the hexamerous, which seems to be the primary stage in *Chthamalus*—thus no increase of the number of the plates in the ontogeny.

In a discussion of the phylogeny of cirripedes we have also to take into account the mouth-parts, which I think represent very conservative formations of the body. In the sessile group we can thus from the mouth-parts distinguish a Chthamalid series from a Balanid. This division can also be based on the wall-plates. Most genera of the first series have a free rostrum which seems to be lost in the later series, except in the genus *Chelonibia*, where it is small and fused with the rostro-lateralia into one compartment. Among the Balanid series there is one, *Tetracrita*, for which I (1921) proposed a new subfamily Tetracritinæ of the family Balanidæ. Judging from the mouth-parts, the genus shows resemblance to both series, but there is much to be said for regarding it as a Balanid form, as did Darwin. The small number of plates is surely arrived at by reduction. I think Runnström (1925) has drawn too many conclusions from his study of the development in *Balanus balanoides* when he holds *Tetracrita* with four plates to be an ancient form from which other species with a greater number of plates, as, e. g., *Balanus* and *Chthamalus*, have arisen. If it is shown in some cases that an increase of the number of the plates has taken place, we cannot prove that all genera of the sessile barnacles have been formed in that way. As that is fully discussed by Withers (1928), it need not here be wholly taken up. The climax of the development by reduction and fusion of the valves is arrived at in the genus *Pyrgoma*, where the four plates are fused together. If we try to trace the details of this development I believe it is very difficult in many cases. Instead of saying that a genus is derived from another now living, I

think that in some cases we shall come nearest to the truth if we say from a form very like a recent one. In that way I will here endeavour to discuss the phylogeny of this interesting genus *Chionelasmus*.

It is of the greatest importance in this genus to note the presence of one whorl of supplemental valves and six interior compartments in the wall. Such whorls of smaller plates are found even in the fossil Upper Senonian genus *Brachylepas*, H. Woodward (1901), Withers (1912). This genus, with a reduced number of interior compartments and several whorls of exterior supplemental valves, is considered by Withers (1928) to be an independently developed sessile type which probably resembled the ancestor of the Chthamalid *Catophragmus*. Of the now living genera this latter is most related to *Chionelasmus*. Pilsbry, who considered *Chionelasmus* to have eight compartments in the wall, thought it was an intermediate form between *Pachylasma* and *Catophragmus*, but belonging to the latter genus. Here it is shown that the number of interior plates is only six and the whorl of supplemental valves single. It must thus be a new genus. The affinity with *Pachylasma* is not very great. There are yet some resemblances in the opercular plates. This genus has six plates in the wall, but the rostral plate is formed by fusion of a real rostrum and two rostro-laterals, and there are no supplemental valves. In this connection it may be pointed out after Broch (1927) that we have not wholly cleared up the homologies of the plates in the wall in all genera. It is difficult, I think, to distinguish a carino-lateral plate from a lateral in full-grown individuals, as both have a radius and an ala. Generally the former plate is narrower than the latter; in some forms very small (Withers, 1928, p. 57). I therefore name the broad compartments on both sides of the carina in genus *Chionelasmus* lateral plates (which is identical with Pilsbry's carino-lateral for the same species). As he thought there were eight plates, it was quite correct to call them carino-lateral plates. In the ancestor of the genus *Chionelasmus* there was, I think, a carino-lateral plate as in *Catophragmus*. This plate is supposed to have been lost in many Chthamalid species, as, e. g., *Chthamalus* and *Chamaesipho*, but not in *Pachylasma* and *Hevelasma*.

It is of interest to compare the new genus with the most similar now living, viz., *Catophragmus*. The supplemental scales in this latter genus seem to be very like those of the interior wall. In *Chionelasmus* they are rather different and of three types. Also in the opercular plates of both genera

there are some differences in the shape, but some distant resemblance can, however, be traced. The non-porous wall in both genera is a character common to the whole Chthamalid group. The base is in *Catophragmus* membranous in one species, and but thinly calcareous in another (*C. imbricatus*). In *Chionelasmus* it is also found to be thinly calcareous. In most Chthamalids it is membranous, which, I think, is a primitive feature for this group.

The mouth-parts of *Chionelasmus* are of the Chthamalid type, and especially characteristic is the labrum without a notch on the more or less concave edge. Of other parts the mandible and maxilla II. are much alike in both genera, but in this regard also resemblance to many other genera of the Chthamalid series exists. More different are the palpus and the maxilla I. in both genera. Of other internal parts there are also to be noted the caudal appendages. Such appendages are very common in the pedunculate genera. About these I wrote (1921, p. 150):—"Dagegen hat der Caudalanhang bei der Ermittlung der Verwandtschaft geringere Bedeutung," which is especially valid for the Pedunculata, as the appendage is less common in the Operculata, but represented in some ancient genera as *Verruca*, *Pachylasma*, *Catophragmus*, and *Chthamalus* (one species). Presence of these appendages, I think, is surely a primitive character, but the appendages are no conservative parts of the body to judge from their uneven occurrence in the genera and species. In *Catophragmus* it may be noted for *C. imbricatus*, Sowerby, 1827, *C. pilsbryi*, Broch, 1922, but not for *C. polymerus*, Darwin, 1854. In *Chionelasmus* the appendage is well developed and rather long. As it is also very long in *Chthamalus caudatus*, but totally lost in the other species of *Chthamalus*, we cannot from that only draw any conclusions.

How ought then, finally, this new genus *Chionelasmus* to be placed in a phylogenetical tree? I believe we cannot now completely answer this question unless we pass over to pure conjecture. We see the same (Nilsson-Cantell, 1921, 1925) if we want to group the well-known genera with five plates, *Lepas*, *Conchoderma*, and *Pæcilasma* for instance. As no younger stages are known of *Chionelasmus*, we get no help from the ontogeny. It may be possible that the genus represents an intermediate form between such genera with several whorls of supplemental valves as *Catophragmus* and such without those but with six interior compartments in the wall as *Chthamalus*. An argument for that is the reduction of the number of internal plates to six and of the number of

whorls of supplemental valves to one in *Chionelasmus*. But we must not be too hasty to note the descent from the genus *Catophragmus*, as the supplemental valves are very different in both genera, and, as shown above, many other differences exist. In this case I incline to the view that it is derived from a *Catophragmus*-like form by the side of that genus—with many or perhaps one row of supplemental valves,—we do not know which. In accordance with the theory of development by the increase of the number of plates the new genus would be regarded as the descendant of a form with six interior plates by the addition of supplemental valves. From the above discussion I am more inclined to the belief that here a reduction has taken place.

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LIX.—*New Cretaceous Crabs from England and Syria.*

By THOMAS H. WITHERS, F.G.S.

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[Plate XIII.]

AMONG the Cretaceous Decapod Crustacea in the British Museum two specimens are noteworthy for adding to our imperfect knowledge of Cretaceous Crabs.

One, *Creticarcinus purleyensis*, gen. et sp. n., occurs in the Lower Senonian, a horizon in the English Chalk from which crabs are practically unknown.

The other, from Syria, is a new species of the genus *Notopocorystes*, a genus hitherto known only in its restricted sense from the Cretaceous of England, although related crabs referred to the genus *Palæocorystes* have been described from the Cretaceous of England, Germany, and Vancouver Island. This crab, as far as can be seen in the characters preserved, is intermediate between *Notopocorystes stokesi* (Mantell) and *Palæocorystes broderipi* (Mantell), and thus suggests—what, indeed, I had previously supposed—that the genera *Notopocorystes*, McCoy, *Palæocorystes*, Bell, and *Eucorystes*, Bell, cannot be satisfactorily separated.

Notopocorystes was founded by McCoy (1849) on two species, *N. mantelli* (= *Corystes stokesi*, Mantell, 1844) and *Necrocarcinus bechei* (Eudes-Deslongchamps) = *Orythia labescheii*, Eudes-Deslongchamps, 1835, p. 40, pl. i. figs. 7, 8 (non fig. 9), from the Gault and Cambridge Greensand. The latter species has no affinity with the former, and it is here chosen as the genoelectotype of *Necrocarcinus*, Bell (1863, p. 19), and the specimen figured by Eudes-Deslongchamps (pl. i. figs. 7, 8) is here chosen as the lectoholotype of the species *Necrocarcinus bechei*, his fig. 9 representing a specimen of *Orithopsis bonneyi* (Carter). *Notopocorystes mantelli* (= *Corystes stokesi*, Mantell) remains as the genotype of *Notopocorystes*, McCoy. Later (1854), McCoy described another species, *N. carteri*, from the Cambridge Greensand.

Bell (1863) substituted the name *Palæocorystes* for *Notopocorystes* because McCoy misunderstood the structure of the genus. *Palæocorystes* is thus, by definition, synonymous with *Notopocorystes*. Bell included in *Palæocorystes* the species *P. stokesi* (Mantell), *P. broderipi* (Mantell,

1844), and *P. normani*, Bell, and for *Notopocorystes carteri*, McCoy, he founded the new genus *Eucorystes*.

Carter (1898) accepted Bell's generic name *Palæocorystes* with the species *P. stokesii* and *P. normani*, although he was inclined to regard the latter merely as a variety of the former, and not only did he include in *Eucorystes* the species *E. carteri* and *E. broderipi*, but he said (p. 25):—"The characters which Bell assigned to his genus *Eucorystes* apply so precisely to *E. broderipi* that I do not hesitate, notwithstanding the remarks of that experienced author, to transfer this species from the genus *Palæocorystes* to *Eucorystes*. The specific alliance between *E. carteri* and *E. broderipi* is very close. The feature which especially distinguishes them is the series of singular lingulate markings which occur on the cephalic area of *E. carteri*, but are entirely absent in *E. broderipi*. The orbito-frontal border is relatively narrower, but in other characters the two species correspond so precisely as even to suggest the probability that they may be local varieties of the same form, characterized by the difference of surface-features."

Van Straelen (1923) discussed these and other genera, illustrating his remarks with diagrammatic figures of the ventral surface, and paying particular attention to the form of the sternites. He accepted four genera with eight species distributed as follows:—

NOTOPOCORYSTES.	<i>N. stokesi</i> (Mantell); <i>N. normani</i> (Bell).
EUMORPHOCORYSTES.	<i>E. sculptus</i> , Binkhorst, 1857.
EUCORYSTES.	<i>E. carteri</i> (McCoy); <i>E. callianassarum</i> (Fritsch, 1887).
PALÆOCORYSTES.	<i>P. broderipi</i> (Mantell); <i>P. lævis</i> , Schlüter, 1868; <i>P. harveyi</i> , H. Woodward, 1896.

So far as the English species are concerned the Albian (Gault) *Notopocorystes stokesi* is followed in the Chalk by the somewhat rare *N. normani*. The form found in the intervening Cambridge Greensand, and always referred to *N. stokesi*, has the cephalothorax strongly convex transversely and the orbito-frontal margin constricted, thereby approaching nearer to *N. normani*. These three forms evidently constitute a lineage.

Notopocorystes stokesi occurs commonly in the Gault, and its successor is as common in the Cambridge Greensand. Other species of crabs occur both in the Gault and in the

Cambridge Greensand. This being so, it has always seemed to me curious that while *Palæocorystes broderipi* occurs commonly in the Gault, not only are no specimens found in the Cambridge Greensand, but its place is there taken by the common crab, *Eucorystes carteri*, unknown in the Gault. This latter form is distinguished from *P. broderipi* by peculiar markings on the anterior surface. McCoy regarded these strap-like markings as representing the lobes or regions of the cephalothorax, but Bell did not agree to this. Carter suggested that they are modifications produced by the confluence or expansion of prominences, which in *Necrocarcinus*, *Campylostoma*, and other genera, occur in the form of areolar tubercles.

The Cambridge Greensand form of *Notopocorystes stokesi* almost always has the true outer shell preserved, and this was no doubt due to the protection afforded by the strong median ridge and prominent tubercles, the latter being always more or less worn smooth. *Eucorystes carteri*, on the other hand, having neither a median ridge nor prominent tubercles, has the layers of shell almost entirely removed, although in some individuals remains of one or two layers can be seen, especially in the less prominent parts; therefore, the specimens almost take the form of internal casts.

In my opinion, therefore, *Eucorystes carteri* is the Cambridge Greensand derivative of the Gault *Palæocorystes broderipi*: the peculiar markings represent the raised parts of the cephalothorax, on which the shell-layers have been partly or entirely worn through: and except in a very general way these worn parts do not accord with the regions of the cephalothorax.

The differences shown in Van Straelen's diagrams, adapted after Bell, of the sternites of *P. broderipi* and *E. carteri*, are not borne out by an examination and preparation of the specimens; and inaccuracy is shown also in the diagram of *Notopocorystes stokesi*, in which the episternum is not round but angular, differing only slightly from *P. broderipi*.

In short, *Eucorystes carteri* is the Cambridge Greensand descendant of the Gault species *Palæocorystes broderipi*, and the differences are mainly those of preservation and horizon. Further, my inclination is towards including *Notopocorystes stokesi* and *Palæocorystes broderipi* in the same genus (by priority *Notopocorystes*), for their structure is not so widely different as the published figures would lead one to suppose. The foreign species have not been seen by me, so that it is impossible to express any further opinion on them.

A specimen of *Notopocorystes broderipi* in the British Museum, registered In. 27329, from the Gault of Folkestone, shows that the last pair of legs are not only shorter and elevated above the others, but the segments of the limb are short, broad, and flattened, and the ovate, leaf-like dactylus has its extremity somewhat acute and slightly curved outwards—features which are closely paralleled in the genus *Ranina*, in which the limb appears to be used for swimming and digging. Restorations of *N. broderipi* so far given have the segments of the hindmost pair of legs long and slender and a lance-like dactylus, as in the Recent *Corystes*.

Family Raninidæ.

NOTOPOCORYSTES, McCoy, 1849.

Notopocorystes syriacus, sp. n. (Pl. XIII. figs. 1-3.)

Diagnosis. A *Notopocorystes* with a strong median keel, a low node behind the cervical furrow, and three tubercles on the hepatic lobe. Antero-lateral margins with three small spines, the anterior one about midway between the cervical furrow and the outer orbital spine; above the cervical furrow the antero-lateral margin is inclined inwards. Outer surface with comparatively coarse pits and fine granules, but with no tract of fine granules along the postero-lateral margins.

Distribution. Upper Cretaceous (? Cenomanian): Mt. Lebanon, Syria.

Holotype. A unique cephalothorax (Pl. XIII. figs. 1-3) in the Geological Department of the British Museum (*Rev. C. H. V. Gollmer collection*, 1896, labelled "B, 4"), registered I. 8407.

Description. Cephalothorax elongate-ovoid, broadest in its anterior third, moderately convex transversely, with a strong median longitudinal ridge and a well-marked cervical furrow. Length incomplete; breadth about 40 mm. Antero-lateral margins produced into three spines, the posterior one small and situated a little below the cervical furrow, the second slightly larger and situated at the angle below the cervical furrow, and the third, about the same size as the second, some distance above the cervical furrow, and about midway between it and the outer orbital spine. On the median ridge a low but strong tubercle is situated immediately behind the cervical furrow, and it may be that there were other tubercles on this ridge. Three low tubercles are situated on the hepatic lobe: the inner one forming the anterior prominence

of a tumid lobe just below the outer fissure of the upper orbital lobe ; a smaller one situated a little to the right of the inner tubercle ; and a third much smaller tubercle placed in line with the second, and near the angle formed by the upturned cervical furrow. Two deep hollows, one almost behind the other, are situated on each side of the median ridge behind the cervical furrow, the lower one evidently ending in a curved furrow which marks off the cardiac region ; a third, much smaller, hollow is seen on each side of, and close to, the median ridge on the cervical furrow. Orbito-frontal margin incomplete, but no doubt more than half the width of the cephalothorax ; the outer orbital fissure can be seen just above the inner tubercle on the hepatic lobe. Outer surface with comparatively large closely disposed pits, the interspaces covered with fine granules ; postero-lateral margins irregularly granulate. Branchiostegite broken and displaced, but there are three small wide-spaced tubercles in its upper part, the anterior one being in line with the third antero-lateral spine. Third maxillipedes much elongated, with both stalks flatly rounded, and the outer stalk slightly curved inwards.

Comparison with other species. This crab from Syria is somewhat intermediate between *Notopocorystes stokesi* and *N. broderipi*. With the former it agrees in the presence of a prominent median longitudinal ridge, but differs in the absence of the prominent spines or tubercles on the surface of the cephalothorax. It is obviously close to *N. broderipi*, for the differences are not very striking. The cephalothorax is not nearly so flattened transversely, a feature emphasized by the presence of a strong median longitudinal ridge ; and just below the cervical furrow, where in *N. broderipi* it is so completely flattened that the cervical furrow is flattened out, there is a low, but prominent, node. On the antero-lateral margin the spines are not nearly so strong, but of more importance is the fact that the anterior spine is situated at a relatively longer distance from the cervical furrow, and the antero-lateral margin immediately above the cervical furrow is directed inwards at a more acute angle. Not only is the surface more coarsely pitted, but there is no tract of fine granules adjoining the postero-lateral margins. No doubt more complete specimens would show further differences. Although perhaps of little consequence, it is a fact that this, the only known specimen, is larger than any of the numerous specimens of *N. broderipi*, none of which have a breadth exceeding 33 mm.

Family Xanthidæ.

Genus CRETICARCINUS, nov.

Diagnosis. Xanthid crabs with the cephalothorax broadly oval, length about four-fifths the breadth; front straight, about one-third the breadth of the cephalothorax; orbits large, semicircular; branchial and cardiac lobes tumid; surface ornamented with coarse and sparsely distributed tubercles.

Creticarcinus purleyensis, sp. n. (Pl. XIII. figs. 4, 5.)

Diagnosis. As for genus.

Distribution. Lower Senonian (base of *Micraster cor-tudinarium* zone): Road-section on Foxley Hill, Purley, Surrey.

Holotype. A unique cephalothorax (Pl. XIII. figs. 4, 5) collected by Mr. G. F. Brown, and now in the Geological Department of the British Museum, In. 27330.

Description. Cephalothorax broadly and transversely oval, slightly convex from side to side, and moderately convex from front to back, length about four-fifths the breadth (length 15.6 mm., breadth 20 mm.), the surface ornamented with coarse and sparsely distributed tubercles, and near the middle of the postero-lateral margin by a group of comparatively fine close tubercles. Gastric lobe not very prominent and marked off from the branchial lobes by the obtusely V-shaped cervical furrow, which dies out on reaching the hepatic region. Branchial lobes strongly tumid. Cardiac lobe round and tumid and marked off from the urogastric lobe by a deep depression, and from the branchial lobes by a shallower depression. Antero-lateral margins regularly convex, without spines. Orbits large, semicircular, with no trace of notches. Front rather strongly downturned, wide, almost straight, about one-third the width of the cephalothorax.

Comparison with other species. This specimen cannot be referred to any known genus and species, and it is here described as new. It has some resemblance to the crab described as *Necrocarcinus avicularis* by Fritsch in Fritsch and Kafka, 1887, Crust. Böhmischen Kreidef. p. 47, pl. x. fig. 12, from the Cenomanian (Korytzaner Schichten) of Kamajk, near Caslau, Bohemia. The new crab, however, differs not only in the relatively longer cephalothorax, but in the larger orbits, the long straight front, and the tumid branchial lobes.

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EXPLANATION OF PLATE XIII.

Notopocorystes syriacus, sp. n.

Upper Cretaceous (? Cenomanian): Lebanon, Syria.

Fig. 1. Cephalothorax. Outer surface. $\times 1.5$ diam. Brit. Mus. I. 8407. Holotype.

Fig. 2. Ventral view of same showing maxillipedes.

Fig. 3. Front view of same.

Creticarcinus purleyensis, gen. et sp. n.Upper Cretaceous (Senonian), Base of *Micraster cortestudinarium* zone: Purley, Surrey.Fig. 4. Cephalothorax. Outer view. $\times 2$ diam. Brit. Mus. In. 27880. Holotype.

Fig. 5. Front view of same.

LX.—*A Note on the Occurrence of the Coreid Melanacanthus margineguttatus, Distant, in New Zealand.* By J. W. EVANS, B.A.

THE family Coreidæ has no representatives in the endemic fauna of New Zealand, and I know of only one doubtful record of a species having been introduced*. This record occurs in a letter from the late Dr. Bergroth addressed to Dr. Myers, dated 6th October, 1924, in which the writer states that contained in a collection of Heteroptera from New Zealand was a single specimen of a Coreid of the genus *Leptocoris* (*Serinetha*) bearing the label "Taihape," and collected by G. Howes. Taihape is well inland in the North Island, so it is strange that what is presumably an introduced species should have been found in such a locality, especially as Mr. T. R. Harris, a very careful collector, has never taken it, though he has collected extensively over very similar country at Okahune.

In March 1928 Mr. E. S. Gourlay, of the Cawthron Institute, and I caught numerous specimens of *Melanacanthus margineguttatus*, Distant, at Tahuna, on the north coast of the South Island. The genus *Melanacanthus* is confined to Australia, and this particular species occurs in Queensland, having been taken in the far north as well as in the south of that state.

The insects were taken in flight and on marram-grass (*Psamma arenaria*), on sand-dunes near the sea. This plant is not indigenous, but was introduced from Europe a number of years ago to prevent the drift of wind-blown sand, its long adventitious roots helping to anchor the dunes.

In the early part of April the grass was fired, and those insects that survived the fire probably fell prey to flocks of sparrows which were seen on the dunes a few days after the burning had taken place. It is unlikely that Tahuna was the only locality in which this Coreid had established itself, but should this have been the case, it is probably now wiped out.

* Myers and China, in their list of New Zealand Heteroptera, have recorded *Dindymus versicolor*, H.-S., as a Coreid taken in New Zealand; this species, however, belongs to the Pyrrhocoridae, as pointed out by Kirkaldy in his "List of the Hemiptera of the Maorian Subregion," published in the 'Transactions of the New Zealand Institute,' vol. xli. (1909). Dr. Myers states that the above insect was inadvertently listed as a Coreid, due to a slip on his part.

I wish to thank Mr. W. E. China for kindly identifying *M. margineguttatus* for me and Dr. J. G. Myers for giving me the information in Dr. Bergroth's letter.

REFERENCE.

MYERS, J. G., and CHINA, W. E. 1928. "A List of New Zealand Heteroptera." *Ann. & Mag. Nat. Hist.* ser. 10, vol. i. p. 385.

LXI.—*Note on Stenurus ovatus (v. Linstow), a little-known Lung-worm of Cetacea.* By H. A. BAYLIS, M.A., D.Sc.

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VON LINSTOW (1910) described a Nematode, which he named *Pseudalius ovatus*, from *Delphinus tursio* (the bottle-nosed dolphin, now known as *Tursiops truncatus*). He gives the habitat of the worm as the œsophagus and stomach. The species belongs, however, to the group of *Metastrongylidæ* which usually inhabit the air-passages and blood-vessels of *Cetacea*, and it is probable that the worms in von Linstow's case had reached the œsophagus accidentally or wandered there after the death of the host.

The head of a specimen of *Tursiops truncatus* which had been stranded at Penzance was recently received at the British Museum (Natural History) *. In the blow-hole, larynx and trachea were found numerous specimens of a worm which evidently is v. Linstow's species. This, on the basis of v. Linstow's description, has already been referred by Baylis and Daubney (1925) to the genus *Stenurus*, Duj., 1845. The object of the present note is to confirm this view of the systematic position of the species, and to point out certain slight differences between the present material and v. Linstow's description.

As regards the general measurements of the worms, little need be added to v. Linstow's account. In the present collection the males measure 15–20 mm. in length and 0·14–0·17 mm. in maximum thickness, the females 17–32 mm. and 0·21–0·23 mm. respectively, the size attained, especially by the females, being thus a little larger than in von Linstow's case.

* Another specimen stranded later at Worthing was found to harbour the same parasite.

Von Linstow describes the mouth as being surrounded by six very small papillæ, and mentions four rather larger submedian papillæ situated behind these. In the genotype, *Stenurus minor*, and in *S. globicephalæ* (see Baylis and Daubney, 1925) there are two circles of six cephalic papillæ, those of the anterior circle being very small. In the present species, however, the writer has been unable to detect the anterior papillæ. They may be present on the border of the mouth, which is rather prominent, especially laterally, and has a rounded contour. If present, however, they must be exceedingly small and difficult to observe. The two lateral and four submedian papillæ of the posterior circle are present as usual, though not very prominent. There is, in *S. minor*, a fairly well-developed buccal capsule, and in *S. globicephalæ* a very shallow one. In *S. ovatus* there seems to be nothing that can be called a buccal capsule, though the cuticular lining of the œsophagus is reflected over its anterior end and slightly thickened. The head is very small, its diameter, at the level of the papillæ, not exceeding about 0.055 mm. The œsophagus is somewhat club-shaped behind, and measures 0.43–0.52 mm. in length. There is a pair of rather prominent and button-like cervical papillæ. These and the excretory pore are situated at 0.27–0.32 mm. from the anterior end, while the nerve-ring is at 0.19–0.21 mm. from the same point.

The caudal end of the male is fairly accurately described and figured by v. Linstow (1910, figs. 1 & 2). The rays of the bursa agree with his account and with the generic diagnosis given by Baylis and Daubney (1925, p. 204). In the writer's material, however, the spicules, though of the general form indicated by v. Linstow (which is that characteristic of the genus), are much smaller. Von Linstow gives their length as 0.28 mm., while in the present specimens they are only 0.17–0.18 mm. long, including the broad, apparently fused, posterior portion and the slender, handle-like anterior portion. The accessory piece also, which is 0.15 mm. long according to v. Linstow, here measures only about 0.07 mm.

As regards the posterior end of the female, the paired terminal processes figured by v. Linstow (1910, fig. 3) are a very characteristic feature of the species, but their form is rather variable. Occasionally they end in rounded knobs, as indicated by von Linstow, and as in the specimen here shown in fig. 2. More often, however, they are conically pointed, as in fig. 1. The ventral cuticular swelling near the caudal

end is more or less distinctly divided by a transverse constriction, and von Linstow appears to have misinterpreted the positions of the anus and vulva. The anus (fig. 1, *a.*) is at the posterior edge of the swelling, and hidden by it in a ventral view (fig. 2). The vulva is situated on the swelling itself, near its anterior edge (fig. 1, *v.*), and is thus almost

Fig. 1.

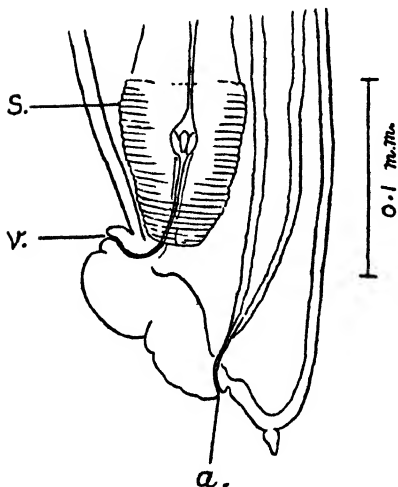
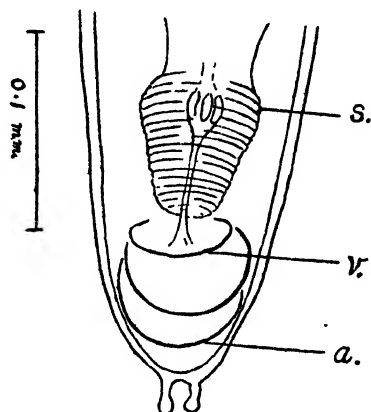


Fig. 2.



Stenurus ovatus (v. Linstow).

Fig. 1.—Posterior end of female, lateral view. *a.*, anus; *s.*, sphincter; *v.*, vulva.

Fig. 2.—Posterior end of female, ventral view. *a.*, position of anus; *s.*, sphincter; *v.*, position of vulva.

in the position indicated by v. Linstow for the anus in his fig. 3. The vagina is very short and is surrounded by a large sphincter (figs. 1 & 2, *s.*).

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LXII.—*On some Polychæta of the Family Polynoidæ from Tahiti and the Marquesas.* By C. C. A. MONRO.

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INTRODUCTION.

Dr. C. Crossland kindly entrusted me with the determination of these Polychæta, collected by him in the Central Pacific and presented to the British Museum.

Genus THORMORA, Baird.

Thormora johnstoni (Kinberg).

Lepidonotus johnstoni, Kinberg, 1857, p. 12, pl. iv. fig. 13.

Thormora jukesi, Baird, 1865, p. 199.

Thormora johnstoni, Monro, 1928, p. 556.

For the rest of the synonymy, *vide* Monro, 1924, p. 37.

Occurrence.—Tahiti, 36 specimens; Marquesas, 10 specimens; shore-reef, Papetoai, Maorea, 1 specimen.

Remarks.—These specimens are very striking because of the colour of their elytra, which are dark green except for their externo-lateral border, which is white, and for the small white spot over the elyrophore.

In a number of specimens the border in the first three or four pairs of elytra is dark red.

The anterior half of the second pair of elytra is white, and that portion of it which is left uncovered by the posterior border of the first pair gives the effect of a transverse white band across the front part of the back. Microscopic examination shows that the elytra are sparsely dotted with small tubercles, and that near the edge of the scar of attachment the surface is thickened and raised in a sort of incipient crest. The pigment is very dense. The dorsum is nearly black, the colouring being arranged in close transverse lines.

If we compare these specimens with examples from the Pacific mouth of the Panama Canal on the one hand, and from East Australia on the other, we would seem to be dealing with three different species.

The Panama specimens, which I believe to be the same as the *Lepidonotus johnstoni* of Kinberg, have the first pair of elytra and the anterior half of the second either colourless or pale grey, and the rest of the scales are a chestnut-brown. Anteriorly they are furnished in the middle with large

hooked spines. Furthermore, there is a conspicuous pigment-spot in the mid-dorsum of each segment and the elytra overlap in the middle line.

The East Australian specimens, on the other hand, are very much larger, being quite twice the size of the examples from the other two localities, and the elytra are beset with large granular tubercles (pustules), not found in the other examples. The colour has completely faded, so that no comparison of this character can be made. If the differences in body-size and also in the state of expansion or contraction of the notopodial bristles be allowed for, no distinctive character is discoverable in the bristles.

However, the differences in the elytra and in the general facies of the three forms would have justified their separation into different species, had not I seen two specimens from the Maldives which to some extent bridge the differences between them. In size the Maldivic examples are slightly larger than the Marquesan; the first pair of elytra and the anterior half of the second are colourless, as in the Panama specimens, and there is a small transverse band of pigment on the mid-dorsum. The elytra are dotted with pustules, similar in kind to those of the East Australian specimens, but much smaller, and, except for the anterior pair of elytra, the arrangement of the dark green pigment is somewhat similar to that in the Marquesan specimens.

Collector's Notes.—Dr. Crossland made the following notes on the living specimens from Tahiti:—"Collected from reef-edge material, in the wash of the surf. Deep green, practically black. Some anterior elytra are tinged dark purple over the green, in one specimen the first two pairs, in the other the first five. The bases of the tentacles are also purple. On posterior elytra this colour is confined to the posterior external margin. Body is white, with transverse lines of black-green mid-dorsally; these marks are usually hidden under the elytra. Ventral chætæ short, stiff and brown; dorsal fine, colourless and directed dorsally, holding up the edge of the elytra. Elytra completely cover the body and overlap. They are dark green, with concentrated spots of the same, making them appear black, but for a few white dots. Posterior outer part has much less colour and is transparent. Feet, being white, make a strong contrast. Underside is also white."

Genus SCALISSETOSUS, M'Intosh.

Scalisetosus papilliferus, Horst.

Scalisetosus papilliferus, Horst, 1917, p. 99, pl. xxi. figs. 2-4.

Occurrence.—Tahiti and Papetoai Bay, Maorea.

Remarks.—The three fragmentary specimens do not enable me to add anything to Horst's description. The *Scalisetosus* bristles, combined with the curious papillæ, render this species easily distinguishable.

Genus ALLMANIELLA, M'Intosh.

Allmaniella marquesensis, sp. n.

Occurrence.—Tai O Hae Pool, the Marquesas. Coll. Crossland.

Description.—Eight specimens, the largest measuring 9 mm. by 5 mm. including the feet, the smallest 7 mm. by 2 mm. The general body-colour in spirit is black, and there are two transverse light stripes to each segment, one of which runs down the dorsal surface of the foot. The elytra are dark green, with lighter edges and a light patch above the scar of attachment. The prostomium is as broad as it is long and covered with minute black dots. The posterior pair of eyes is situated far back on the prostomium, and each eye is surrounded by an unpigmented area. The anterior is situated so near the lateral edges that the eyes can scarcely be seen from above. The insertion of the lateral tentacles is subterminal and the median emerges from the top of the prostomium. All the tentacles have the ceratophores very distinct. The median tentacle is long and fine, ending just short of the palps, and the laterals are very small, consisting of a stout ceratophore and a minute whip-like style. They are about one-fourth the length of the median tentacle. The palps are stout tapering structures, pigmented about their bases and lighter distally. The tentacular cirri are about equal in length to the median tentacle. The elytra (fig. 1) leave the dorsum uncovered in the median line; they are very loosely attached, quite smooth except for a small area between the scar of attachment and the margin, where there is a group of small tubercles, and profusely sprinkled with small pigment-grains. The elytraphores are very prominent and dorsal tubercles are present. The dorsal cirri are very long, extending beyond the tips of the chætæ; the ventral are small, not reaching to the end of the foot.

Fig. 1.

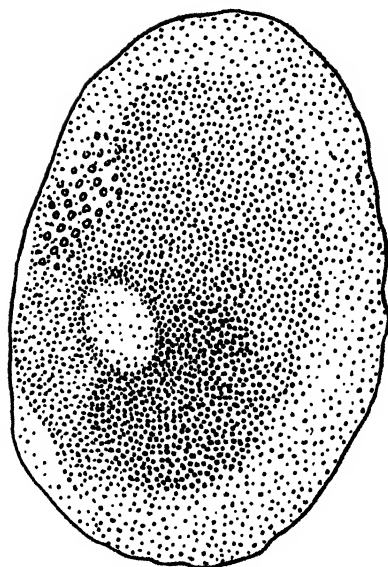
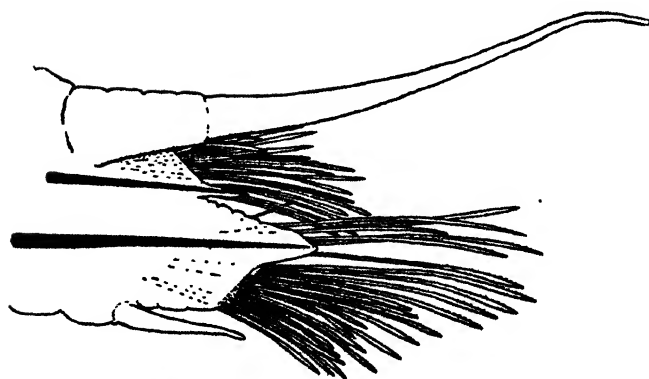


Fig. 2.



Allmaniella marquesensis, sp. n.

Fig. 1.—Elytron, $\times 55$.

Fig. 2.—Middle foot, $\times 60$.

The shape of the foot (fig. 2) is typical of the genus. Both dorsal and ventral divisions have long digitiform prolongations which contain the acicula, the dorsal being a thin sheath covering the projecting aciculum. The fan-shaped dorsal fascicle contains chætæ (fig. 3), which are small, slightly curved, with fine denticulations on the convex side. The ventral chætæ have a long subterminal dilatation with rows of spines and a bifid tip. In the more dorsal chætæ of the neuropodium there is a smooth area beneath the tip. This almost disappears in the shorter more ventral chætæ (fig. 4).

Remarks.—This genus was based by M'Intosh on a specimen dredged off Setubal. Unfortunately, there is not enough of the type-specimen left to be of use for purposes of comparison. Horst (1917, p. 78) describes an *Allmaniella*

Fig. 3.

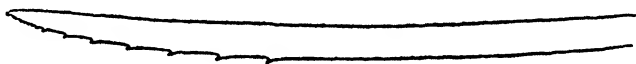
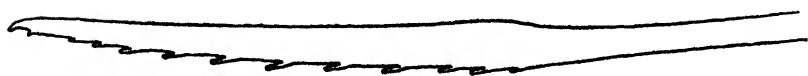


Fig. 4.



Allmaniella marquesensis, sp. n.

Fig. 3.—Dorsal chaeta, $\times 435$.

Fig. 4.—Ventral chaeta, $\times 435$.

arafurensis from the Arafura Sea, and rightly transfers (p. 79) Grube's *Polynoë ptycholepis* to this genus. The specimens from the Marquesas differ from Horst's species in the shape of the feet. They are very close to Grube's species, but they are without the pronged tubercles on the elytra found in *A. ptycholepis*.

Genus *IPHIONE*, Kinberg.

Iphione ovata, Kinberg.

Iphione ovata, Kinberg, 1857, p. 8, pl. iii. fig. 8.

Occurrence.—Moorea Island, Papetoai Bay, 20 fath.; Tai O Hae, Marquesas, Tahiti.

Remarks.—Five specimens; they are distinguished from

Iphione muricata by the absence of a fringe on the edge of the elytra.

Collector's Notes.—Dr. Crossland made the following notes on the living specimens from Tahiti:—"Uniform bright red above and below; elytra the same, with addition of dark brown specklings within honeycomb ridgings. The outer edge of the elytra is less coloured and is membranous, while the rest of the elytron is stiff. Neuropodial chætæ stiff and golden; notopodial thin and colourless, not long, but forming a fringe all along the sides outside the elytra."

Genus *HARMOTHOË*, Kinberg.

Harmothoë atra, Horst.

Harmothoë atra, Horst, 1917, p. 89, pl. xx. figs. 1-2.

Occurrence.—Tahiti and Tamioai reef, Tahiti.

Remarks.—Three fragmentary specimens, the largest measuring 8 mm. by 2 mm. including the feet, which I doubtfully attribute to this species. They differ from Horst's description in a number of particulars. The prostomium is longer than broad, unpigmented, and not deeply incised at the base of the median tentaculophore. The anterior pair of eyes are large and lie beneath and to the side of the frontal peaks, the posterior on the top of the head in front of the nuchal fold. The median tentacle is about as long as the prostomium, and the laterals, inserted some distance back on the ventral surface of the head, are only one-third of its length. The bases of the median and the laterals are marked with dark brown pigment. The palps are long, slender, and colourless, quite twice the length of the median tentacle. In Horst's figure the palps have the appearance of being much contracted.

There is a dark spot in the median line on the dorsal surface of each segment, and the elytra, except for the first pair (which are round and colourless), are splashed with black on their inner sides. There is also a small black patch by the point of attachment to the elytraphore.

The elytra have a number of tubercles on their inner side which are replaced in the middle by blunt spines. On the edge are a few small clavate papillæ.

The feet and chætæ seem to correspond with Horst's description, but the ventral cirrus is not "dilated in its distal part and tapering distally." It is dilated proximally and tapers towards the tip.

The anterior position of the first pair of eyes, situated

just below the frontal peaks, connects this species with *Harmothoe areolata*, Grube, and *Harmothoe terminoculata*, Monro; in which the eyes are similarly placed. It differs, however, in the form of its elytra.

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LXIII.—*The Brevicipitid Frogs of the Genus Microhyla*.

By H. W. PARKER, B.A.

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THE material on which this revision is based is chiefly that in the British Museum; in addition, the author has had the full use of Dr. Malcolm Smith's private collection and a number of specimens have been most courteously lent by the Museum of Zoology, Amsterdam, the Museum of Comparative Zoology, Harvard University, and the American Museum of Natural History. The author also wishes to express his indebtedness to Miss Cochran for information concerning some of the type-specimens in the U.S. National Museum.

Of the species at present* referred to this genus only one, *M. bungurana* (Gunther), has been found to belong elsewhere. Examination of the type-specimens has revealed the presence of a well-developed clavicle and pro-coracoid and a cartilaginous sternum and omosternum; the species must, apparently, be referred to the genus *Kalophrynus*.

MICROHYLA, Tschudi.

Hysaplesia (part.), Boie in Férussac, Bull. Sci. Nat. ix. 1826, p. 239.

Hylaplesia (part.), Boie in Schlegel, Isis, xx. 1827, p. 294.

Microhyla, Tschudi, Mem. Soc. Sci. Neuchâtel, ii. 1839, p. 71 (1838);

Boulenger, Cat. Batr. Sal. Brit. Mus. (2) p. 163 (1882); id. Fauna

* *Microhyla leucostigma*, Boulenger, has already been referred to the genus *Sphenophryne*, Smith, Journ. Sarawak Mus. iii. 1925, p. 12.

- Brit. India, Rept. & Batr. p. 491 (1890); id. Fauna Malay Penin., Rept. & Batr. p. 258 (1912); Sarasin, Zool. Jahrb., Supp. xii. i. 1910, p. 18; Vogt, Sitzber. Ges. Natf. Fr. Berlin, iii. 1911, p. 183; id. *op. cit.* 1913, p. 223; Smith, Journ. Nat. Hist. Soc. Siam, ii. 3, 1917, p. 229; Rao, Rec. Ind. Mus. xv. 4, 1918, p. 41; Prashad, Rec. Ind. Mus. xv. 1918, p. 101; Barbour, Occ. Pap. Mus. Zool. Michigan, lxxvi. 1920, p. 2; Robinson & Kloss, Journ. F.M.S. Mus. viii. 1920, p. 305; Van Kampen, Amph. Indo-Austr. Archip. p. 152 (1923); Nieden, Das Tierreich, Anura, ii. p. 27 (1926).
Engystoma (part.), Dum. & Bibr. Erpet. Gen. viii. p. 738 (1841).
Siphneus, Fitzinger, Syst. Rept. p. 33 (1843).
Dendromanes, Gistel, Naturg. Thierr. p. 11 (1848).
Diplopelma (part.), Gunther, Cat. Batr. Sal. B.M. i. p. 50 (1858).
Michryla, Gunther, *op. cit.* p. 121.
Scaptophryne, Fitzinger, Sitzber. Ak. Wien, xlii. 1861, p. 416.
Callula (part.), Cope, Journ. Ac. Sci. Philadelphia, (2) vi. 1867, p. 192.
Ranina (non Lamarck), David, Nouv. Arch. Mus. Paris, vii., Bull. 1872, p. 416.

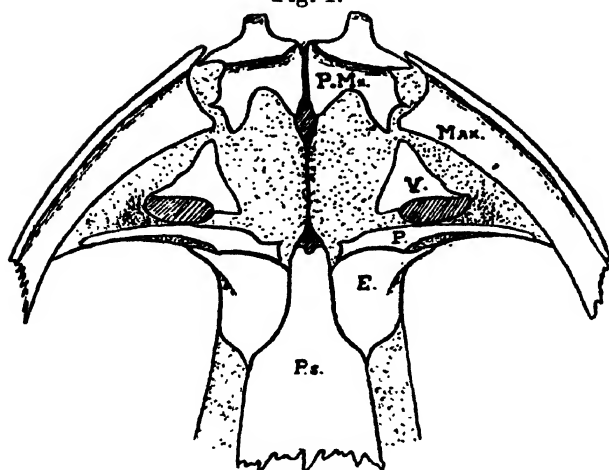
Teeth absent. Tongue elliptic, entire, and free behind; one or two dermal ridges across the palate in front of the pharynx. Tympanum hidden. Pupil circular. Fingers free; toes free or webbed, the outer metatarsals united. Tips of digits pointed or expanded into well-developed discs whose upper and lower surfaces are separated by a horseshoe-shaped groove; this groove may have a median dorsal branch which extends as a cleft on to the upper surface of the disc, dividing it into two pads.

Vomerine bones present, without backwardly directed process; palatine bones present or absent; no pro-coracoids, clavicles, or omosternum; terminal phalanges T-shaped in those species with digital discs, otherwise simple.

Tadpoles with lateral eyes, median vent and spiraculum, terminal mouth, poorly developed upper lip, no horny jaws or teeth, and the tip of the tail usually ending in a whip-like flagellum.

The exact relationships of the genus are not apparent, though it is possible to form an estimate of some of the characters which in this genus are primitive. The bones of the roof of the mouth have been examined in all except three of the species here considered valid, and the condition of the palatine region allows of the subdivision of the genus into four series; in *M. berdmorei*, *annectens*, *annamensis*, and *palmipes* the palatine bone is well developed (fig. 1); in *M. butleri* this bone is still present, but reduced in size (fig. 2); in *M. heymonsi*, *achatina*, *pulchra*, *okinavensis*, *ornata*, *picta*, and *rubra* the palatine bone is entirely absent, and the cartilage of the posterior part of the nasal capsule shows signs of partial calcification (fig. 3); in *M. inornata* there is again no trace of a palatine bone proper, but either

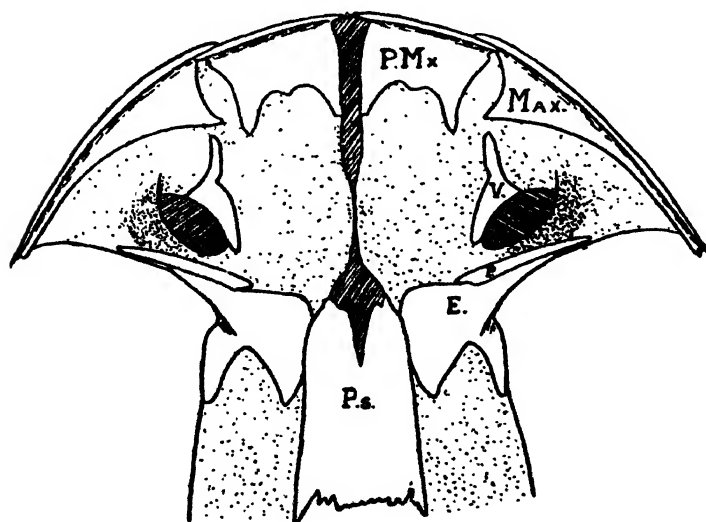
Fig. 1.



Anterior elements of skull of *M. berdmorei*, seen from beneath;
from a cleared specimen.

P.Mx., premaxilla; *Max.*, maxilla; *V.*, vomer; *P.*, palatine;
E., ethmoid; *Ps.*, parasphenoid.

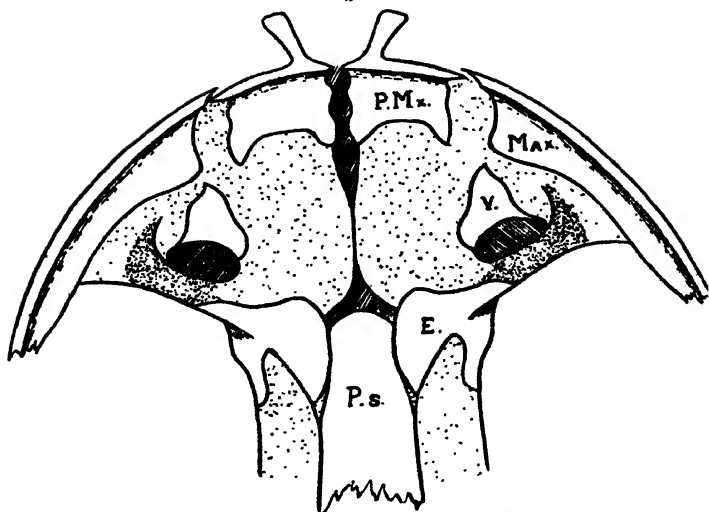
Fig. 2.



Anterior elements of skull of *M. butleri*, seen from beneath;
from a cleared specimen.

Lettering as in fig. 1.

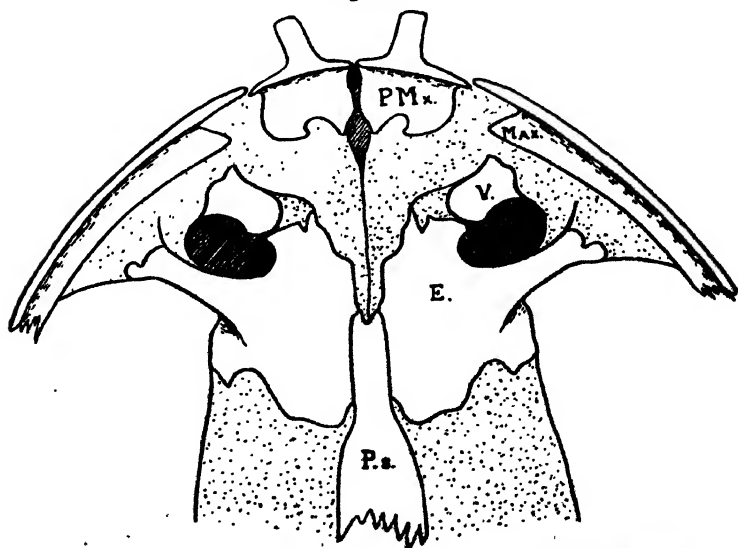
Fig. 3.



Anterior elements of skull of *M. heymonsi*, seen from beneath;
from a cleared specimen.

Lettering as in fig. 1.

Fig. 4.



Anterior elements of skull of *M. thomasi*, seen from beneath;
from a cleared specimen.

by fusion of the ethmoid with the calcified cartilage of the nasal capsule which appears in the last group, or by a lateral encroachment of the ethmoid, this bone now borders the internal nares and occupies the position of the true palatine (fig. 4). Further consideration of these groups shows that all species in the first have well-developed digital discs, T-shaped terminal phalanges, and toes $\frac{3}{4}$ to fully webbed. *M. butleri*, which stands alone in the second group, has small, but distinct, digital discs, T-shaped terminal phalanges, and less fully webbed toes ($\frac{1}{2}$ to $\frac{3}{4}$). The members of the third group show all gradations from small, but distinct, digital discs and T-shaped terminal phalanges (*heymonsi* and *achatina*) to pointed toes and simple terminal phalanges (*ornata* and *pulchra*), and, if the burrowing forms *picta* and *rubra* be excepted, the toes are not or but slightly more than $\frac{1}{2}$ webbed. In *M. inornata*, of the last group, there are no discs, the terminal phalanges are simple and there is no trace of webbing. Thus there appears to be complete correlation between the reduction and loss of the palatine bones followed by ossification of the posterior ventral border of the nasal capsule and the reduction and loss of the digital discs and the reduction of the interdigital membranes.

In all the tadpoles hitherto described the developing hind limbs are *fully webbed*, reduction to the adult condition taking place on metamorphosis; as these limbs are never used by the tadpole, the tail alone serving for locomotion, the presence of this webbing appears to have no functional significance and is probably an ancestral character. The presence of a palatine, too, must be considered a primitive character, so that the most primitive members of the genus would appear to be those allied to *M. berdmorei*, and it is possible to trace a complete orthogenetic series from this species through *M. annectens*, *M. butleri*, *M. achatina*, *M. heymonsi*, *M. okinavensis*, and *M. ornata* to *M. inornata*; *M. rubra* and *M. picta* are probably specialised offshoots from some such form as *M. ornata*.

The tadpoles of this genus are all microphagous and, except in *M. berdmorei*, the tail ends in a whip-like flagellum. When feeding they remain stationary and continually taking in mouthful after mouthful of water which is filtered by the gills and passed out through the spiraculum; during this process the tail is bent back along itself so as to lie almost parallel with the body and the flagellum maintained in rapid vibration. The exact function which the flagellum subserves is unknown, but it may be a mechanism for enabling the tadpole to retain its position in the water. The mechanical

effect of the continuous passage of a stream of water backwards from the spiraculum would be to drive the tadpole forwards; it is possible that the vibration of the flagellum sets up a forward current of the same momentum as the backward spiracular current and so maintains the animal in its original position.

Synopsis of the Species.

- I. Palatines present or absent; ethmoids not extending laterally beyond the middle of the choanæ and not bordering them. Usually two metatarsal tubercles, but if only one, toes $\frac{3}{4}$, or more, webbed.
- A. Metatarsal tubercles not shovel-shaped.
 - (1) Digital discs present, large and more or less distinctly grooved on their upper surface. Palatine bone present. Toes at least $\frac{1}{2}$ webbed.
 - (a) Toes entirely webbed; two metatarsal tubercles (1) *M. berdmorei*.
 - (b) Toes $\frac{3}{4}$ webbed; two metatarsal tubercles, 1st finger reduced [sp. n.]
 - (c) Toes $\frac{3}{4}$ to $\frac{1}{2}$ webbed; an inner but no outer metatarsal tubercle; 1st finger reduced. (2) *M. borneense*,
 - (i.) Toes $\frac{3}{4}$ webbed; skin smooth..... (3) *M. annectens*.
 - (ii.) Toes $\frac{3}{4}$ webbed; skin rough (4) *M. annamensis*.
 - (d) Toes $\frac{1}{2}$ to $\frac{1}{4}$ webbed; two metatarsal tubercles (5) *M. butleri*.
 - (2) Digital discs present, large, without any trace of a median cleft; toes $\frac{1}{2}$ webbed. Palatine bone present.
 - (a) No supraciliary spine; fingers moderate, the two outer with discs and inner $\frac{1}{4}$ to $\frac{1}{2}$ the length of the longest. (6) *M. palmipes*.
 - (b) A supraciliary spine; fingers reduced, scarcely dilated distally and inner scarcely $\frac{1}{4}$ the length of the longest.. (7) *M. superciliaris*, [sp. n.]
 - (3) Digital discs present, small, with a median cleft; toes not more than $\frac{1}{2}$ webbed; palatine bone absent.
 - (a) Outer metacarpal tubercle divided; a continuous dark lateral band from end of snout to groin; a ()-shaped dark spot on the centre of the back (8) *M. heymonsi*.
 - (b) Outer metacarpal tubercle single; lateral dark band interrupted above the shoulder; no () mark on the centre of the back (9) *M. achatina*.
 - (4) No digital discs; palatine bone absent.
 - (a) Toes more than $\frac{1}{2}$ webbed (10) *M. pulchra*.
 - (b) Toes less than $\frac{1}{2}$ webbed.
 - (i.) Toes with or without traces of a groove on the upper surface of

- their tips. Tibio-tarsal articulation reaching eye in ♀♀ and from anterior border of eye to beyond end of snout in ♂♂; toes of ♀♀ fringed (11) *M. okinavensis*.
- (ii.) Toes without any trace of groove on their tips. Tibio-tarsal articulation not extending beyond eye; toes not fringed (12) *M. ornata*.
- (iii.) Tibio-tarsal articulation extending beyond end of snout; toes $\frac{1}{2}$ webbed. (13) *M. melli*.
- B. Metatarsal tubercles shovel-shaped. Toes $\frac{1}{2}$ webbed; no digital discs. Palatine absent.
- (1) Outer metacarpal tubercle single (14) *M. picta*.
- (2) Outer metacarpal tubercle divided (15) *M. rubra*.
- II. Palatines absent; ethmoids co-ossified with palatal region and extending outwards to lateral edge of choanae and bordering them. A single metatarsal tubercle. Toes not dilated distally and free (16) *M. inornata*.

Synopsis of the Tadpoles.

- I. Lower lip produced into a funnel, which almost surrounds the mouth.
- A. A knob-like protuberance on each side of the mouth within the oral disc. Ratio of internarial to interocular distances $\frac{1}{2}$ or less *M. heymonsi*.
- B. A boss with a central depression, sucker-like, on each side of the mouth within the oral disc. Ratio of internarial to interocular distances $\frac{1}{2}$ or greater *M. achatina*.
- II. No funnel-like projection of the lower lip.
- A. Head squarish anteriorly; tail without terminal flagellum; depth of tail more than $\frac{1}{2}$ its length. *M. berdmorei*.
- B. Head rounded anteriorly; tail with a terminal flagellum; depth of tail not more than $\frac{1}{2}$ its length.
- (1) Spiraculum opening under a flap which extends posteriorly almost to the anterior edge of the anal opening; latter large, slit-like, and with its edges pigmented *M. butleri*.
- (2) Spiracular opening about the centre of the gut, well separated from the anus which is small, circular and without pigmented lips.
- (a) Tail less than twice as long as head and body *M. ornata*.
- (b) Tail twice or more than twice as long as head and body *M. rubra*,
M. pulchra.

1. *Microhyla berdmorei* (Blyth).

Engystoma ? *berdmorei*, Blyth, Journ. As. Soc. Bengal, xxiv. 1856, p. 720; Mason, Burma, ed. 2, p. 325 (1860).

Diplopelma berdmorei, Gunther, Zool. Rec. iv. 1868, p. 146; Anderson, Proc. Zool. Soc. 1871, p. 153; Stoliczka, Proc. As. Soc. Bengal, 1872, p. 109.

- Microhyla berdmorei*, Boulenger, Cat. Batr. Sal. B.M. ed. 2, p. 166 (1882); id. Fauna Brit. Ind., Rept. & Batr. p. 492 (1890); Sclater, Batr. Ind. Mus. p. 23 (1892); Flower, Proc. Zool. Soc. 1896, p. 908; id. *op. cit.* 1899, p. 906; Werner, Zool. Jahrb. Syst. xiii. 1900, p. 496; Butler, Journ. Bomb. Nat. Hist. Soc. xv. 1904, p. 390; van Kampen, Zool. Jahrb., Syst. xxii. 1905, p. 713; Boulenger, Fauna Malay Penin., Rept. & Batr. p. 263 (1912); Smith, Journ. Nat. Hist. Soc. Siam, ii. 1916, p. 169; Van Kampen, Amph. Indo-Austr. Arch. Leiden, p. 158 (1923) (in part.*); Nieden, Das Tierreich, Anura, ii. 1926, p. 33.
- Microhyla berdmorei*, Laidlaw, Proc. Zool. Soc. 1900, p. 888.
- Microhyla berdmorei* (tadpole), Smith, Rec. Ind. Mus. xxvi. 1924, p. 141, pl. vii. fig. 1.
- Callula natatrix*, Cope, Journ. Ac. Philadelphia, (2) vi. 1867, p. 192.
- Diploelma pulchrum* (in part.), Theobald, Journ. As. Soc. Bengal (Cat. Rept. Mus. As. Soc. Bengal), 1868, p. 83.
- Microhyla malcolmi*, Cochran, Proc. Biol. Soc. Washington, xl. 1927, p. 182.

Habit slender. Snout obtuse, slightly shorter or slightly longer than the diameter of the eye; interorbital space as broad as, or broader than, the upper eyelid. Digits dilated distally, the toes terminating in distinct, moderately large discs, with more or less distinct traces of a median groove on their upper surface. Fingers slender, the first much shorter than the second; toes long, entirely webbed in the adult, the web reaching the discs of all except the fourth; the toes of newly-metamorphosed specimens only $\frac{2}{3}$ webbed; subarticular tubercles distinct; two small metatarsal tubercles. Occasionally fibro-cartilaginous sesamoid developments may occur in the tendon of Achilles on the tibio-tarsal and tarso-metatarsal joints; the former of these produces a shovel-like swelling at the proximal end of the tarsus and the latter underlies the outer metatarsal tubercle giving it also a shovel-like appearance. Hind limbs long, the tibio-tarsal articulation reaching well beyond the tip of the snout. Skin smooth or with small tubercles which may form longitudinal ridges especially from the supra-acapula region to the groin. A more or less distinct shallow groove from behind the eye to the fore-limb. Ground-colour of the upper surfaces olive to purplish brown or pinkish; usually traces of a black marking from the supra-scapular region along the flanks. The essential pattern of the dorsal surface consists of a large dark spot beginning on the head, stretching from eyelid to eyelid, and truncate anteriorly; this narrows behind the occiput, broadens above the shoulders, narrows halfway between the tip of the snout and the vent,

* The description of the tadpole given in this reference is really that of *M. butleri* (vide Smith, 1924).

broadens and sends postero-laterally a branch towards the groin, narrows immediately posterior to the branches, and finally broadens and sends a branch towards each hind-limb. This marking may be perfectly distinct, and sometimes outlined by a narrow white line, or may be entirely indistinct; frequently it is distinct anteriorly but indistinct behind, and occasionally it may be broken up into isolated spots, the breaks occurring at the narrow regions. Hind limbs cross-barred; a longitudinal dark streak often present on the anterior face of the thigh and usually a black, light-margined area round the vent; lower surfaces of tarsus and foot usually darker. Sides of head with indistinct, vertical, dark bars. Lower surfaces yellowish white, the throat infusate.

Palatine bone well developed.

Distribution. Burma, Siam, Cambodia, Malay Peninsula, Sumatra.

M. malcolmi, Cochran, appears to be based on an aberrant individual of this species, the sesamoid developments having reached an excessive size. An undoubted specimen of *berdmorei* from the type-locality of *malcolmi* shows approximately the same proportions as the latter, and also has the digital grooves rather indistinct; about nine specimens in Dr. Smith's collection show greater or less sesamoid development.

Microhyla borneense, sp. n.

Microhyla annectens, Boulenger, Fauna Malay Penin., Rept. & Batr. p. 262 (1912) (in part.); Van Kampen, Amph. Indo-Austr. Arch. p. 156 (1922) (in part.); Smith, Sarawak Mus. Journ. iii. 8, 1925, p. 32; Nieden, Das Tierreich, Anura, ii. p. 32 (1926) (in part.).

Type-specimen a ♀, no. 1911. l. 30. 43, in the British Museum, collected in the Kidi district, Sarawak, by C. J. Brooks, Esq.

Habit slender. Snout rounded, slightly projecting, once and a quarter as long as the diameter of the eye. Fingers and toes moderate, dilated distally into distinct discs with a median groove on their upper surfaces; first finger very short; fourth longer than second; toes between $\frac{1}{2}$ and $\frac{3}{4}$ webbed, the web almost reaching the discs of the first and second toes on their inner margin, but leaving two phalanges of the third and fifth toes and three of the fourth toe free; sub-articular tubercles well developed; two metatarsal tubercles, the inner elongate, the outer conical. Tibio-tarsal articulation reaching somewhat beyond the end of the snout; tibia $\frac{3}{4}$ the length of the head and body. Skin smooth; a slight fold from the posterior angle

of the eye to the fore limb. Above, light brown with an ill-defined darker area along the middle of the back; this stretches from eyelid to eyelid, being truncate anteriorly, narrows behind the occiput, broadens and gives off a short branch towards the fore limbs, narrows on the middle of the back, and widens and becomes indistinct behind this point. A dark brown streak from above the shoulder to the middle of the flank. Hind limbs very indistinctly cross-banded; a dark spot on the front of the knee. A dark, light-edged area above the vent. Upper lip with three dark brown spots. Lower surfaces yellowish white, faintly mottled with light brown.

Snout to vent 18 mm. Fore limb 8 mm. Hind limb 31 mm.

This new species is closely allied to *M. annectens*, the species with which it has previously been confounded, *M. berdmorei*, and *M. annamensis*; from *annamensis* it differs in having two metatarsal tubercles, smooth skin, a slightly longer snout, and less fully webbed toes; from *annectens* it differs in having two metatarsal tubercles and shorter hind limbs; from *berdmorei* it differs in its colour-pattern, reduced first finger, less fully webbed toes, shorter hind limbs, and much smaller size.

Microhyla annectens, Boulenger.

Microhyla annectens, Boulenger, Ann. & Mag. Nat. Hist. (7) vi. 1900, p. 188; Butler, Journ. Bombay Nat. Hist. Soc. xv. 1904, p. 389; Boulenger, Fauna Malay Penin., Rept. & Batr. p. 262 (1912) (in part.); Smith, Journ. Nat. Hist. Soc. Siam, ii. 1916, p. 169; Van Kampen, Amph. Indo-Austr. Arch. p. 156 (1922) (in part.); Nieden, Das Tierreich, Anura, ii. p. 32 (1926).

Habit slender. Snout rounded, as long as, or slightly longer, than the diameter of the eye, slightly projecting. Interorbital space broader than the upper eyelid. Fingers and toes slender, the tips dilated into distinct discs with a median groove on their upper surface; first finger very short, second shorter than fourth; toes $\frac{2}{3}$ webbed; sub-articular tubercles moderate; an inner, but no outer, metatarsal tubercle; tibio-tarsal articulation reaching well beyond the tip of the snout. Skin smooth. Brown above with a black bar from above the shoulder along the flanks towards the groin; a symmetrical darker marking on the back, commencing between the eyes, where it connects the upper eyelids, narrowing behind the occiput, widening between the fore limbs, narrowing again and then becoming indistinct; a dark cross-bar each on the thigh, tibia, and

tarsus ; a black spot on the anterior aspect of the knee, and another round the vent ; a light streak, sometimes black-bordered posteriorly, from below the eye to the fore limb ; the head from the centre of the eyes to the tip of the snout may be greenish, and there may be a triangular black spot on the lip in front of the eye. Lower surfaces lighter, closely marbled with dark brown. A fine white line may be present on the back from snout to vent.

Palatine present.

Malay Peninsula and Peninsular Siam.

All the specimens referred to this species which have been examined from Sumatra, Nias, and Java have proved to belong to *M. palmipes*.

Microhyla annamensis, Smith.

Microhyla annamensis, Smith, Journ. Nat. Hist. Soc. Siam, vi. i. 1923, p. 47, pl. v. fig. 2.

Habit moderately slender. Snout obtuse, as long as, or a little longer than, the diameter of the eye ; interorbital space broader than the upper eyelid. Digits dilated distally, the discs being well developed and with a median groove on their upper surfaces ; fingers slender, the first very short ; second and fourth subequal or the fourth longer than the second ; toes $\frac{3}{4}$ webbed ; subarticular tubercles feebly developed ; a small inner, but no outer, metatarsal tubercle ; the tibio-tarsal articulation reaches the tip of the snout or beyond. Skin more or less warty or tubercular above ; smooth beneath. Grey-brown above, with a short black streak above each shoulder ; an angular dark patch on the centre of the back between the arms, and indistinct darker markings may be present posteriorly ; usually indications of a triangular dark spot between the eyes, and of a light line from beneath the eye to the fore limb. Limbs indistinctly cross-barred. Lower surfaces white, more or less thickly speckled with brown.

S. Annam.

Palatine present.

Microhyla butleri, Boulenger.

Microhyla sp.? (tadpole), Flower, Proc. Zool. Soc. London, 1899, p. 903, pl. lx. fig. 2 ; Nieden, Das Tierreich, Anura, ii. 1926, p. 36, fig.

Microhyla butleri, Boulenger, Ann. & Mag. Nat. Hist. (7) vi. 1900, p. 188 ; Butler, Journ. Bombay Nat. Hist. Soc. xv. 1904, p. 388 ; Boulenger, Fauna Malay Penin., Rept. & Batr. p. 261 (1912) ; Smith, Journ. Nat. Hist. Soc. Siam, ii. 4, 1917, p. 268 (tadpole) ;

- id. *op. cit.* iv. 1922, p. 214; id. Journ. F.M.S. Mus. x. 1922, p. 281; id. Journ. Nat. Hist. Soc. Siam, ii. 1923, p. 212; Nieden, Das Tierreich, Anura, ii. p. 31 (1926).
- ? *Microhyla boulengeri*, Vogt, Sitzber. Ges. Natf. Fr. Berlin, 1913, pp. 222, 227, 229; id. Arch. Naturges. lxxxviii. 10, 1922, p. 145; Nieden, Das Tierreich, Anura, ii. p. 35 (1926).
- Microhyla berdmorei*? (tadpole), Annandale, Mem. As. Soc. Bengal, vi. 1917, p. 151; Rao, Rec. Ind. Mus. xv. 4, 1918, p. 42; Van Kampen, Amph. Indo-Aust. Arch. pp. 153 & 158 (1923).
- Microhyla latastii*, Boulenger, Ann. & Mag. Nat. Hist. (9) vi. 1920, p. 107.
- Microhyla hainanensis* (non Barbour), Mell, Archiv. Naturg. lxxxviii. 10, 1922, p. 131.
- Microhyla grahami*, Stejneger, Occ. Pap. Boston Nat. Hist. Soc. v. 1924, p. 119; id. Proc. U.S. Nat. Mus. lxxvi. 25, 1925, p. 13.
- ? *Microhyla sowerbyi*, Stejneger, Occ. Pap. Boston Nat. Hist. Soc. v. 1924, p. 119; id. Proc. U.S. Nat. Mus. lxxvi. 25, 1925, p. 14.

Habit slender. Snout rounded, slightly prominent, as long as or longer than the diameter of the eye. Fingers and toes slender, dilated distally into more or less distinct discs with a median groove on their upper surfaces; first finger much shorter than the second, which is shorter than the fourth; toes webbed, the degree of webbing variable, usually $\frac{1}{4}$ to $\frac{1}{3}$, but sometimes as much as $\frac{1}{2}$; the web continuous along the toes as a rather indistinct fringe; a fairly distinct ridge along the edge of the outer metatarsal continuous with the fringe on the outer side of the fifth toe; subarticular tubercles prominent; two small metatarsal tubercles and a small, sometimes indistinct, diagonal ridge from the base of the inner towards the centre of the tarsus; sometimes a very small tubercle on the tarsus near the tibio-tarsal articulation; tibio-tarsal articulation reaching the eye or the tip of the snout. Skin smooth or tubercular above, smooth beneath. Greyish or brownish above with darker markings on the back; these markings consist essentially of a single large marking which commences between the eyelids, connecting the two, narrows considerably behind the head, broadens abruptly between the fore limbs, narrows slightly and then sends a branch posterolaterally towards the groin, narrows immediately, and finally broadens and sends a diagonal branch on to each femur; this marking is frequently edged by a lighter band and is often broken up, the breaks occurring at the narrowest points, viz. behind the head and on the sacral region; posteriorly the marking may become indistinct and anteriorly the spot may be still further reduced, giving a triangular spot between the eyes and an)(-shaped figure or a dark transverse bar on the back; a light streak is usually present from

below the eye to the fore limb and dark spots are often present on the temporal region and above the fore limb. The tubercles, particularly in young specimens, lighter, red in life. Limbs and digits with narrow, dark, cross-bars; lower surfaces white, the throat of the male infusate.

Palatine present, but much reduced.

Distribution. S. China (Fukien and Sze-chwan), Tonkin, Hainan, Siam, Cochinchina, and Malay Peninsula.

This species is very variable in coloration, in the size of the digital discs, and in the extent of the webbing between the toes. In a series of about 50 specimens examined, perhaps the most constant diagnostic characters found are the ridge along the outer metatarsal and the diagonal fold from the inner metatarsal tubercle. A topotypic specimen of *M. grahami* received from Dr. Stejneger is not distinguishable from Siamese specimens, and young examples from Hainan which agree well with Vogt's description of *M. boulengeri* are also apparently referable to this species. No specimens of *M. sowerbyi*, or from Fukien, its type-locality, have been examined, but the characters in which it is said to differ from *M. grahami* are the characters in which this species is so variable; it has accordingly been referred provisionally to the synonymy of the present species, despite the fact that no specimens have been collected in the country between Fukien and Tonkin.

Microhyla palmipes, Boulenger.

Microhyla palmipes, Boulenger, Ann. & Mag. Nat. Hist. (6) xix. 1897, p. 108; Van Kampen, Amph. Indo-Austr. Arch. p. 157 (1923); Nieden, Das Tierreich, Anura, ii. p. 33 (1926).

Microhyla annectens (non Boulenger, 1900), Van Kampen, Zool. Ergeb. Ned. Ost. Ind. iv. 2, 1907, p. 404; Barbour, Mem. Mus. Comp. Zool. Harvard, xlv. 1912, p. 71, pl. vii. fig. 26; Boulenger, Fauna Malay Penin., Rept. & Batr. p. 262 (1912) (in part.); Annandale, Journ. F.M.S. Mus. vii. 1917, p. 108; Boulenger, Journ. F.M.S. Mus. viii. 1920, p. 295; Robinson and Kloss, Journ. F.M.S. Mus. viii. 1920, p. 305; Van Kampen, Amph. Indo-Austr. Arch. p. 156 (1923) (in part.); Nieden, Das Tierreich, Anura, ii. p. 32 (1926) (in part.); Dunn, Am. Mus. Novit. 315, 1928, p. 4.

Microhyla niasensis, Van Kampen, in Kleinweg de Zwaan, Die Insel Nias bei Sumatra, p. 279 (1915).

Microhyla berdmorei (non Blyth), Smith, Journ. F.M.S. Mus. x. 1922, p. 281.

Habit slender. Snout rounded, slightly prominent, as long as, or slightly longer than, the diameter of the eye; interorbital space broader than the upper eyelid. Tips of outer fingers and toes dilated into small but distinct discs whose upper and lower surfaces are separated by a horse-shoe-shaped groove; no trace of a median groove on their

upper surfaces; fingers slender, first much shorter than second, which is subequal to the fourth; toes $\frac{3}{4}$ to $\frac{1}{2}$ webbed; subarticular tubercles small; two small metatarsal tubercles; tibio-tarsal articulation reaching the tip of the snout or slightly beyond. Skin smooth or slightly tubercular above; usually a very small tubercle on the posterior half of the upper eyelid near its free edge; an indistinct glandular fold from the posterior corner of the eye to the fore limb and another above this, above the fore limb to the middle of the flank. Purplish brown above with a black streak, sometimes broken up or indistinct, below the upper glandular fold; back with a darker marking commencing between the eyes and connecting the upper eyelids, narrowing behind the head, widening abruptly between the fore limbs, narrowing slightly and then gradually widening and becoming more indistinct posteriorly; frequently a black spot at the extremity of each inter-scapular projection; a light streak from below the eye to the fore limb; a dark bar across the forearm, femur, tibia, and tarsus, and a black spot in front of the knee and in front of the heel; anal region black; lower surfaces white, more or less closely marbled with brown, females being almost completely white, males thickly spotted with dark brown.

Palatine present.

Distribution. Malay Peninsula, Sumatra, Nias, and Java.

Examination of the collections in the British Museum, the Museum of Zoology, Amsterdam, the Museum of Comparative Zoology, Harvard, and Dr. Smith's collection shows that all specimens recorded as *M. annectens* from Java and Sumatra and *M. niasensis* from Nias lack all trace of a groove on the upper surface of the digital discs and agree with the type of *M. palmipes*. In addition, certain specimens recorded from the Malay Peninsula as *M. annectens* (Boulenger, 1912) and *M. berdmorei* (Smith, 1922) are also referable to this species.

Microhyla superciliaris, sp. n.

Type-specimen, a ♀, no. 1904. 7. 19. 3, from the Batu Caves, Kuala Lumpur, Malay Peninsula.

Habit slender. Snout rounded, slightly prominent, slightly longer than the diameter of the eye. Tips of digits dilated, fingers scarcely at all, toes to small discs whose upper and lower surfaces are separated by a horseshoe-shaped groove; no trace of a median groove on their upper surfaces; first finger extremely short, much shorter than the second, which is subequal to the fourth; third finger

very long, more than twice as long as the second; toes slender, almost fully webbed, the web extending to the discs of all except the fourth; subarticular tubercles scarcely distinct; two small metatarsal tubercles. Tibio-tarsal articulation reaching the tip of the snout. Skin smooth above and below; a prominent spine on the upper eyelid.

Colour in spirit (specimen rather bleached):—Yellowish brown above with an irregular, interrupted, dark streak from behind the eye above the fore limb to the middle of the flanks; indications of a median darker area commencing behind the head expanding between the shoulders, narrowing and then broadening posteriorly; a light streak from behind the eye to the fore limb; upper lip with brown spots; limbs cross-barred; a black spot on the front of the knee; anal region black; lower surfaces yellowish, the throat and chin marbled with light brown.

	mm.
Length from snout to vent.	12
Fore limb	6
Hind limb	18
Head.	4.5
Ovarian eggs nearly 1 mm. in diameter.	

The paratype is also a female, with eggs of about the same dimensions, collected at Deli, Sumatra, by Dr. de Bussy, and now in the Museum of Zoology, Amsterdam. It differs only slightly from the type; the third finger is barely twice as long as the second, and the webbing of the toes is more emarginate, so that they appear to be only $\frac{2}{3}$ webbed.

This new species is closely allied to *M. palmipes*, but is at once distinguishable by the supraciliary spine and the more fully webbed toes.

Microhyla heymonsi, Vogt.

Microhyla achatina (non Bue), Slater, Proc. Zool. Soc. London, 1892, p. 347; id. Batr. Ind. Mus. p. 23 (1892); Werner, Jahresb. Ver. Magdeburg, 1893, p. 254; Flower, Proc. Zool. Soc. London, 1895, p. 908; id. *op. cit.* 1899, p. 909; Laidlaw, Proc. Zool. Soc. London, 1899, p. 888; Werner, Zool. Jahrb., Syst. xiii. 1900, pp. 496, 502 (in part.); Butler, Journ. Bombay Nat. Hist. Soc. xv. 1904, p. 389; Werner, Zool. Jahrb., Syst. xxii. 1905, p. 713 (in part.); Van Kampen, Tid.-chr. v. Ned. Ind. lxi. 1909, p. 45 (tadpole); Boulenger, Fauna Malay Penin., Rept. & Batr. p. 261 (1912) (in part.); Barbour, Mem. Mus. Comp. Zool. Harvard, xlv. i. 1912, p. 17; Robinson & Kloss, Journ. F.M.S. Mus. v. 1915, p. 155; Smith, Journ. Nat. Hist. Soc. Siam, ii. 1916, p. 37, fig. (tadpole); id. *tom. cit.* p. 169; Annandale, Mem. As. Soc. Bengal, vi. 1917, p. 150, pl. vi. fig. 6; Hora, Journ. As. Soc. Bengal, xviii. 1922, p. 12 (tadpole); Van Kampen, Amph. Indo-Austr. Arch. p. 154 (in part.), fig. 22 (1923); Smith, Journ. Nat. Hist. Soc. Siam, ii. 1923, p. 212; Lönnberg & Rendahl, Ark.

- Zool. Stockholm, xvii. A, 23, 1925, p. 3; Smith, Proc. Zool. Soc. London, 1926, pp. 983-986, fig. 2; Nieden, Das Tierreich, Anura, ii. p. 32 (1926) (in part.).
- Microhyla* sp., Van Kampen, Zool. Ergeb. Ned. O. Ind. iv. 2, 1907, p. 405 (tadpole).
- Microhyla fissipes* (non Boulenger, 1884), Boulenger, Ann. & Mag. Nat. Hist. (8) iv. 1909, p. 495.
- Microhyla heymonsi*, Vogt, Sitzber. Ges. Natf. Fr. 1911, p. 181; Stejneger, Proc. U.S. Nat. Mus. lxvi. 1925, p. 13; Nieden, Das Tierreich, Anura, ii. p. 35 (1926).

Habit slender. Snout sub-acuminate, prominent, longer than the diameter of the eye. Digits dilated distally, the discs small but distinct and with a median groove at least on the toes; fingers slender, the first much shorter than the second, which is slightly shorter than the fourth; outer metacarpal tubercle either completely divided or showing signs of longitudinal division by an indentation in its outline distally; toes webbed at the base (less than $\frac{1}{2}$); sub-articular tubercles distinct; two small metatarsal tubercles; tibio-tarsal articulation reaching the eye or the end of the snout. Skin smooth above and below; a slight glandular fold from the posterior corner of the eye to the fore limb. Pinkish or greyish above with a black lateral band extending from the tip of the snout to the groin and entirely covering the sides of the head; this band sharply defined above but merging gradually into the colour of the belly beneath; the dark marking on the centre of the back, which is so characteristic of the preceding species, is here very narrow and often quite indistinct; usually the expansions and contractions are scarcely indicated, and the remainder of the dorsal surface is frequently stippled with tiny dark dots which are arranged in rows parallel with the edges of the median darker area; almost constantly a fine white line from snout to vent, and one, or sometimes two, small, black, sharply-defined ()-shaped spots on the middle of the back; anal region, front of thighs and lower surfaces of tarsus and foot, black; limbs cross-barred; lower surfaces dirty white, the throat and chin infusate.

Palatine absent.

Distribution. Formosa, S. China, Tonkin, Hainan, Siam, Cochinchina, Malay Peninsula, Nias, and Sumatra.

This species is the *Microhyla achatina* of most authors; since, however, the types of true *achatina* came from Java, and appear to be specifically distinct from the present form, the name *achatina* can only be applied to the Javan form (*q. v.*).

Microhyla achatina, Tschudi.

Hypsiplesia achatina, Kuhl & v. Hasselt in Férussac, Bull. Sci. Nat. ix. 1820, p. 239 (nom. nud.).

Hylaplesia achatina, Schlegel, Isis, xx. 1827, p. 294 (nom. nud.).

Microhyla achatina, Tschudi, Mem. Soc. Sci. Neuchâtel, ii. 1839, p. 71 (1838); Dum. & Bibr. Erpet. Gen. viii. p. 615 (1841); Cope, Journ. Ac. Sci. Philad. (2) vi. 1867, p. 193; Boulenger, Cat. Batr. Sal. B.M. ii. p. 106 (1882); Boettger, Ber. Off. Ver. Naturk. 1892, p. 144; Werner, Zool. Jahrb., Syst. xiii. 1900, p. 502 (in part.); [Boettger, Abh. Senck. Natf. Ges. xxv. 1903, p. 327*]; Van Kampen, Zool. Jahrb., Syst. xxii. 1905, p. 713 (in part.); id. Zool. Ergeb. Ned. O. Ind. iv. 2, 1907, p. 404; id. Bull. Dep. Agr. Indes Ned. xxv. 1909, p. 5; Boulenger, Vert. Fauna Malay Penin., Rept. & Batr. p. 261 (1912) (in part.); Barbour, Mem. Mus. Comp. Zool. Harvard, xlv. 1, 1912, p. 71, pl. vii. fig. 27; Van Kampen, Amph. Indo-Austr. Arch. p. 154 (in part.), fig. (1923); Nieden, Das Tierreich, Anura, ii. p. 32 (1926) (in part.); Dunn, Am. Mus. Novit. 315, 1928, p. 4.

Dendromanes achatinus, Gistel, Naturg. Thierr. p. 11 (1848).

Microhyla achatina, Gunther, Cat. Batr. Sal. B.M. i. p. 121 (1858).

Diplopetma disciferum, Peters, Mon. Berlin. Ak. 1867, p. 36.

Engystoma disciferum, Cope, Journ. Ac. Sci. Philad. (2) vi. 1867, p. 194.

Habit slender. Snout subacuminate, prominent, slightly longer than the diameter of the eye. Interorbital space broader than the upper eyelid. Digits dilated, the discs distinct and with a median groove at least on the toes; fingers slender, first much shorter than second, which is slightly shorter than the fourth; outer metacarpal tubercle entire; toes slightly webbed, sometimes almost one-third; subarticular tubercles not very distinct; two small metatarsal tubercles. Tibio-tarsal articulation reaches almost to the end of the snout or beyond that point. Skin smooth above and below. Light pinkish brown above with an irregular dark brown streak from above the shoulder almost to the groin; a light streak from below the eye to the fore limb edged behind by dark brown; upper lip with dark brown spots; centre of back with a median, narrow, darker stripe with undulating margins from between the eyes to the end of the coccyx or with irregular, indistinct, sinuous marblings; anal region and front of thigh dark brown; limbs indistinctly cross-barred; sometimes a fine white line from snout to vent; lower surface whitish, the throat and chin brown spotted.

No palatine.

Java.

* Boettger here records specimens from Ternate and Batjan; as the occurrence of the species in these localities has not been confirmed, this is probably a mis-identification.

A specimen in the British Museum received from the Leyden Museum in 1844 appears to be one of the original specimens collected by Müller and Macklot on which the species *M. achatina* was founded. This specimen and a number of other Javan specimens (seven in the B.M., two in the Amsterdam Museum, and one in the Museum of Comparative Zoology, Harvard) agree with each other and differ from the so-called *achatina* of the Asiatic mainland and Sumatra; the webbing of the toes is slightly greater, the hind leg is usually longer, the outer metacarpal tubercle is never divided, the dark lateral band is not continuous from the end of the snout and there is no trace of the (C)-shaped spot which is so characteristic of the mainland form. The name *achatina* is applicable only to the Javan species and the mainland form must, apparently, be known as *heymonsi*, Vogt.

Thanks to the courtesy of Dr. G. K. Noble, it has been possible to examine tadpoles of the true Javan *achatina*; all the so-called *achatina* tadpoles hitherto described have been really those of *heymonsi*. The two tadpoles are very similar, both being of the "funnel mouth" type and of the same habitus and proportions. In *M. heymonsi*, however, there is at each corner of the mouth, within the expansion of the lower lip, a prominent knob-like protuberance; in *achatina* this knob is rather larger and has a distinct central depression which gives it a sucker-like appearance. Structurally this feature is similar to the radial ridges with which the lower lip is beset. In *achatina* the interanarial distance is proportionately slightly greater than in *heymonsi* and the expansion of the lower lip not quite so pronounced.

Microhyla pulchra (Hallow.).

- Diplopelma ornatum*, Günther, Cat. Batr. Sal. B.M. i. p. 50 (1858) (in part.).
Engystoma pulchrum, Hallowell, Proc. Ac. Philad. 1860, p. 506; Cope, Journ. Ac. Philad. (2) vi. 1867, p. 194.
Diplopelma pulchrum, Gunther, Rept. Brit. Ind. p. 417 (1864); Steindachner, Reise Novara, Amph. p. 36, pl. ii. figs. 15-18 (1867); Theobald, Journ. As. Soc. Bengal (Cat. Rept. Mus. As. Soc.) 1868, p. 83 (in part.); Swinhoe, Proc. Zool. Soc. London, 1870, p. 412; Tirant, Rept. & Batr. Cochinch. & Cambodge, p. 96 (Saigon, 1885).
Microhyla pulchra, Boulenger, Cat. Batr. Sal. B.M. ii. p. 165 (1882); Boettger, Ber. Off. Ver. Naturk. 1885, p. 50; id. *op. cit.* 1888, pp. 99 & 162; Flower, Proc. Zool. Soc. London, 1899, p. 905; Werner, Abh. Bayer. Ak. Wiss. ii. xxii. 2, 1903, p. 370; Wolterstorff, Abh. Mus. Magd. i. 3, 1906, p. 181*; Vogt, Sitzber. Ges.

* Wolterstorff here gives the range of the species as from Ceylon to S. China; as the species does not occur in India or Ceylon this is obviously an error.

- Natf. Fr. Berlin, 1913, pp. 222, 227, 229; Smith, Journ. Nat. Hist. Soc. Siam, ii. 1916, p. 39 (tadpole); id. *tom. cit.* p. 169; Andersson, Vet.-Ak. Handl. Stockholm, lv. 4, 1916, p. 17; Mell, Arch. Naturg. lxxxviii. 10, 1922, p. 131; Vogt, Arch. Naturg. lxxxviii. 10, 1922, p. 145; Smith, Journ. Nat. Hist. Soc. Siam, vi. 2, 1923, p. 211; Parker, Ann. & Mag. Nat. Hist. (9) xv. 1925, pp. 301, 304; Rao & Ramana, Proc. Zool. Soc. London, 1925, pp. 1445-1478; Nieden, Das Tierreich, Anura, ii. p. 31, fig. (1926).
Scaptophyrne labyrinthica, Fitzinger, Sitzber. Ak. Wien, xlii. 1861, p. 416.
Ranina symmetrica, David, Nouv. Arch. Mus. vii., Bull. 1872, p. 76.
Microhyla hainanensis, Barbour, Bull. Mus. Comp. Zool. Harvard, li. 1908, p. 322; id. Proc. New Eng. Zool. Club, iv. 1909, p. 57; id. Mem. Mus. Comp. Zool. Harvard, xlv. 1, 1912, pl. vii. fig. 28; Vogt, Sitzber. Ges. Natf. Fr. Berlin, 1913, pp. 227, 229; id. Arch. Naturg. lxxxviii. 10, 1922, p. 145; Smith, Journ. Nat. Hist. Soc. Siam, vi. 2, 1923, p. 211; Nieden, Das Tierreich, Anura, ii. p. 34 (1926).
Microhyla boulengeri (non Vogt), Mell, Arch. Naturg. lxxxviii. 10, 1922, p. 130*.

Habit slender. Snout prominent, as long as or slightly longer than the diameter of the eye. Interorbital space as broad as, or broader, than the upper eyelid. Digits not dilated and without any trace of a median groove; first finger much shorter than the second, which is subequal to the fourth; toes about $\frac{1}{2}$ webbed; subarticular tubercles well developed; two rather small rounded metatarsal tubercles; tibio-tarsal articulation reaching the tip of the snout or beyond. Skin smooth or very slightly granular above; smooth beneath. Pale olive, greyish, or pinkish brown above; a narrow dark bar from eye to eye, a dark lateral band from behind the eye to the middle of the flanks and an inverted V-shaped marking on the middle of the back, its apex between the shoulders and its extremities near the groin; within the arms of the V two or three collateral V's which are usually incomplete or broken up into lines or elongate spots; forehead and back external to the V with alternately slightly darker and lighter narrow lines, on the forehead parallel with the interorbital marking and on the back parallel with the V. Limbs with numerous cross-bars; hinder side of thighs and groin lighter. Yellowish white beneath, the throat and chest mottled with brown.

No palatine.

Distribution. S. China (Canton), Tonkin, Hainan, Siam, and Cochin-China.

* By accident the names *boulengeri* and *hainanensis* have been transposed in this paper, *vide* Mell *in litt.*

Microhyla okinavensis, Stejneger.

Microhyla fissipes (non Boulenger, 1884), Boulenger, Proc. Zool. Soc. London, 1887, p. 150; Boettger, Ber. Off. Ver. Naturk. 1888, p. 162 (in part.); Okada, Cat. Vert. Jap. 1891, p. 66; Fritze, Zool. Jahrb., Syst. vii. 1894, p. 865; Boettger, Ber. Off. Ver. Naturk. xxxvi. 1895, p. 106.

Microhyla okinavensis, Stejneger, Proc. Biol. Soc. Washington, xiv. 1901, p. 189; id. Bull. U.S. Nat. Mus. lviii. 1907, p. 89; Barbour, Proc. New Engl. Zool. Club, iv. 1909, p. 58.

Microhyla undulata, Brown, Proc. Ac. Philad. 1902, p. 186.

Habit slender. Snout prominent, slightly longer than the diameter of the eye; interorbital space broader than the upper eyelid. Digits not dilated distally to distinct discs, but ending obtusely, and the toes sometimes with traces of a median cleft on their upper surfaces; first finger much shorter than the second; second and fourth subequal; toes with a rudiment of webbing and more or less distinct lateral dermal fringes; subarticular tubercles distinct; two metatarsal tubercles, the inner the larger; tibio-tarsal articulation reaching the eye in the females and from this point to beyond the tip of the snout in males. Skin smooth above and below. Grey to pinkish brown above with a dark lateral stripe from the eye to the middle of the flanks or the groin, sometimes interrupted above the shoulder; a dark mid-dorsal marking commencing between the eyes and connecting the upper eyelids, narrowing behind the occiput, broadening between the shoulders, narrowing slightly and then broadening to give off a very short backwardly directed process, then narrowing abruptly and bifurcating, the two arms extending towards the thighs; the edges of this dark area may be slightly deeper in colour or the whole may be indistinct; a few indistinct wavy bands parallel with the edges of the dorsal spot; hind limbs cross-barred; a dark patch on the anterior aspect of the knee and another around the vent. Lower surfaces white, the throat and chest clouded with pale brown.

Palatine absent.

Distribution. Okinawa- and Ishigaki-Shima, Loo-Choo Islands.

This form is very variable in certain characters; the digital groove, so constant a character in other species, may either be absent or quite well defined; the dermal fringes of the toes are often quite indistinct but in breeding females at least may be very prominent; the leg-length is very variable. Its exact relationships are not very clear; in

general characters it approaches very closely to *M. ornata*. The occasional presence of digital grooves and the persistence of dermal fringes, suggesting the last traces of more fully webbed feet, are characters which, as has been previously pointed out, occur elsewhere in conjunction with the presence of a palatine bone and may be regarded, so far as this genus is concerned, as primitive. It seems possible, therefore, that *M. okinavensis* represents the last remnant of the form from which *M. ornata* has been derived.

Microhyla ornata (Dum. & Bibr.).

- Engystoma ornatum*, Dum. & Bibr. *Erpet. Gen.* viii. p. 745 (1841); Cope, *Journ. Ac. Philad.* (2) vi. 1867, p. 194.
Siphneus ornatum, Fitz. *Syst. Rept.* p. 33 (1843).
Diplopetma ornatum, Gunther, *Cat. Batr. Sal. B.M.* (i.) p. 50 (in part.) (1858); id. *Rept. Brit. Ind.* p. 417 (1864); Theobald, *Journ. As. Soc. Bengal* (Cat. Rept. Mus. As. Soc.) 1868, p. 82 (in part.).
Microhyla ornata, Boulenger, *Cat. Batr. Sal. B.M.* ii. p. 165 (1882); Boettger, *Ber. Off. Ver. Naturk.* 1885, pp. 48, 50; id. *op. cit.* 1888, pp. 98, 162; Anderson, *Journ. Linn. Soc. London*, xxi. 1889, p. 350; Boulenger, *Fauna Brit. Ind. Rept.* p. 491 (1890); Boettger, *op. cit.* 1892, pp. 98, 102; Slater, *Batr. Ind. Mus.* p. 22 (1892); Flower, *Proc. Zool. Soc. London*, 1899, p. 901, pl. lx. fig. 1 (tadpole); Laidlaw, *Proc. Zool. Soc. London*, 1900, p. 887; Boettger, *Ber. Senck. Natf. Ges.* 1901, p. 52; Boulenger, *Fasc. Malay. Zool.* i. 1903, p. 133; Butler, *Journ. Bombay Nat. Hist. Soc.* xv. 1904, p. 387; Ferguson, *Journ. Bombay Nat. Hist. Soc.* xv. 1904, p. 506; Wolterstorff, *Abh. Mus. Magdeburg*, i. 3, 1906, p. 131; Sarasin, *Zool. Jahrb., Syst.* xii. 1, 1910, pp. 131, 134; Boulenger, *Fauna Malay Penin., Rept. & Batr.* p. 260 (1912); Vogt, *Sitzber. Ges. Nat. Fr. Berlin*, 1913, pp. 222, 227; Smith, *Journ. Nat. Hist. Soc. Siam*, ii. 1916, p. 169; id. *op. cit.* ii. 1917, p. 268 (tadpole); Andersson, *Vet.-Ak. Handl. Stockholm*, lv. 4, 1917, p. 17; Rao, *Rec. Ind. Mus.* xiii. 1917, p. 281; id. *op. cit.* xv. 1918, p. 42; Mell, *Arch. Naturg.* lxxxviii. 10, 1922, p. 130; Vogt, *Arch. Naturg.* lxxxviii. 10, 1922, p. 145; Smith, *Journ. Nat. Hist. Soc. Siam*, ii. 1923, p. 212; Parker, *Ann. & Mag. Nat. Hist.* (9) xv. 1925, p. 304; Rao & Ramana, *Proc. Zool. Soc. London*, 1925, pp. 1445-1478; id. *Quart. Journ. Micr. Sci.* lxi. 1925, p. 735 *et seq.* (embryology); Nieden, *Das Tierreich, Anura*, ii. p. 30, fig. (1926).
Engystoma carnaticum, Jerdon, *Journ. As. Soc. Bengal*, 1853, p. 534; Mason, *Burma*, ed. 2, p. 325 (1860).
Diplopetma carnaticum, Stoliczka, *Journ. As. Soc. Bengal*, xxxix. 1870, p. 154; Anderson, *Zool. Yunnan*, p. 841 (1879).
? *Engystoma malabaricum*, Jerdon, *Journ. As. Soc. Bengal*, 1853, p. 534.
Microhyla fissipes, Boulenger, *Ann. & Mag. Nat. Hist.* (5) xiii. 1884, p. 397; Boettger, *Ber. Off. Ver. Naturk.* 1887, p. 162 (in part.); Werner, *Abh. Bayer. Ak. Wiss.* ii. 22, 1903, p. 369; Stejneger, *Bull. U.S. Nat. Mus.* lviii. 1907, p. 88; Vogt, *Sitzber. Ges. Natf. Fr. Berlin*, 1914, p. 101; Mell, *Arch. Naturg.* lxxxviii. 10, 1922,

p. 130; Stejneger, Proc. U.S. Nat. Mus. lxvi. 1925, p. 12; Nieden, Das Tierreich, Anura, ii. p. 35, 1926.

Microhylus eremita, Barbour, Occ. Pap. Mus. Zool. Michigan, lxxvi. 1920, p. 3; Stejneger, Proc. U.S. Nat. Mus. lxvi. 1925, p. 11; Schmidt, Bull. Am. Mus. Nat. Hist. liv. 1927, p. 562.

Habit moderately slender. Snout prominent, slightly shorter or slightly longer than the diameter of the eye; interorbital space broader than the upper eyelid. Digits not dilated distally and without any trace of a median groove; fingers slender, the first much shorter than the second; toes with a rudiment of web but without lateral fringes; sub-articular tubercles distinct; two small prominent metatarsal tubercles; tibio-tarsal articulation reaching to between the shoulder and anterior border of the eye or very slightly beyond the latter point. Skin smooth or slightly tubercular above, and often with small warts, which sometimes form a longitudinal series from the eye to the groin; smooth beneath. Pinkish or olive-grey, or brown above with a more or less defined dark streak from behind the eye, above the shoulder, to the flank; a median dark spot commencing between the eyes where it connects with the upper eyelids, narrowing behind the occiput, broadening abruptly between the fore limbs, narrowing slightly, broadening on the sacral region and sending a branch obliquely backwards to each groin, narrowing immediately and then broadening and bifurcating, each limb being directed obliquely backwards and continued across the thigh; this dark area may be very ill-defined or broken up into isolated spots, the breaks occurring at the narrowed portions; undulating dusky lines sometimes present between the median dark spot and the dark lateral streak; a light streak from the eye to the insertion of the fore limb. The warts and granules often lighter (red in life), particularly in juvenile specimens; limbs cross-barred; anterior aspect of thighs and anal region darker; beneath whitish, the throat and chest closely stippled with brown.

Palatine absent.

Distribution. S. China as far north as Sze-Chwan and Shanghai, Formosa, Tonkin, Hainan, Burma, Assam, Siam, Annam, Malay Peninsula, India, and Ceylon.

This is the most widely distributed of all the species of the genus, but I am unable to find differences which would warrant the erection of subspecies. *M. fissipes*, from Formosa, does not appear to differ in any way from specimens from the Indian region; the slight lateral fringe on the toes which was said to characterize the species is probably

an artifact due to faulty preservation, the type-specimen being hard and shrivelled. Again, the differences which Barbour noted in the type-specimen of *M. eremita* as compared with a specimen of *M. ornata* from Pegu disappear entirely when a series of Burmese and Chinese specimens are compared.

Microhyla melli, Vogt.

Microhyla melli, Vogt, Sitzber. Ges. Natf. Fr. Berlin, 1914, p. 101 ; Mell, Arch. Naturg. lxxxviii. 10, 1922, p. 130.

No specimens examined.
Canton.

Microhyla picta, Schenkel.

Microhyla picta, Schenkel, Abh. Natf. Ges. Basel, xiii. 1901, p. 151, fig.; Smith, Proc. Zool. Soc. London, 1921, p. 437 ; Nieden, Das Tierreich, Anura, ii. p. 30 (1926).

Habit moderately stout. Snout rounded, scarcely projecting, slightly shorter than the diameter of the eye ; inter-orbital space broader than the upper eyelid. Digits not dilated and without any trace of a median groove ; first finger much shorter than the second ; two metacarpal tubercles, the outer entire ; toes short, about $\frac{1}{4}$ webbed and with traces of lateral dermal fringes ; subarticular tubercles distinct ; two large shovel-shaped metatarsal tubercles ; tibio-tarsal articulation reaching to between the shoulder and the posterior border of the eye. Skin smooth or slightly warty above ; a slight glandular fold from the posterior corner of the eye to the fore limb ; smooth beneath. Reddish brown above with a median dark spot which commences between the eyes, where it connects the upper eyelids, narrows behind the head, broadens between the shoulders, narrows slightly and then gives off a branch postero-laterally towards each groin, narrows abruptly and finally broadens and bifurcates, each branch being directed obliquely backwards and continuing across the thigh ; this marking is usually edged with a fine white line and is often broken up into irregular spots ; remainder of upper surface and sides with dark insuliform spots or with irregular darker marblings ; a light streak from behind the eye to the insertion of the fore limb, beneath the glandular fold ; limbs cross-barred ; lower surfaces yellowish, the gular region marbled with brown.

No palatine.

Distribution. Cochin-China and S. Annam.

Microhyla rubra (Jerdon).

Engystoma rubrum, Jerdon, Journ. As. Soc. Bengal, xxii. 1853, p. 584.

Microhyla rubra, Boulenger, Cat. Batr. Sal. B.M. ii. p. 104 (1882); Boettger, Ber. Senck. Naturf. Ges. 1889, p. 298; Boulenger, Fauna Brit. Ind., Rept. & Batr. p. 491 (1890); Selater, Batr. Ind. Mus. p. 22 (1892); Werner, Verh. zool.-bot. Ges. Wien, xliii. 1893, p. 353; Ferguson, Journ. Bombay Nat. Hist. Soc. xv. 1904, p. 506 (tadpole); Annandale, Rec. Ind. Mus. iii. 1909, p. 280; Rao, Rec. Ind. Mus. xi. 1915, p. 31; id. *op. cit.* xiii. 1917, p. 282; id. *op. cit.* xv. 4, 1918, p. 42; Prashad, Rec. Ind. Mus. xv. 1918, p. 101, pl. ix. fig. 10; Nieden, Das Tierreich, Anura, ii. p. 29, fig. (1926); Schmidt, Publ. Field Mus. Chicago, Zool. xii. 1926, p. 168.

Diplopelma ornatum, Günther, Cat. Batr. Sal. B.M. i. p. 50 (1858) (in part.); Theobald, Journ. As. Soc. Bengal (Cat. Rept. Mus. As. Soc.), 1868, p. 82 (in part.).

Habit stout. Snout rounded, scarcely projecting, slightly shorter than the diameter of the eye; interorbital space broader than the upper eyelid. Digits not dilated and without any trace of a median groove; first finger much shorter than the second; two metacarpal tubercles, the outer divided or with an indentation in its outline distally; toes short, webbed at the base, sometimes almost $\frac{1}{2}$ webbed and with traces of lateral fringes; subarticular tubercles well developed; two large shovel-shaped metatarsal tubercles; tibio-farsal articulation reaching to between the shoulder and the eye. Skin smooth or slightly warty above; sometimes a distinct row of warts from the posterior corner of the eye to the flanks; a shallow groove, bordering an indistinct glandular fold from the eye to the base of the fore limb. Reddish brown above with a dark lateral band from the tip of the snout through the eye to the groin; this band sharply defined above, but merging gradually into the ground-colour beneath; an elongate dark brown spot on the lumbar region extending across the thigh; traces, usually indistinct and often broken up, of a median dark spot such as is characteristic of most species of the genus; a dark streak along the anterior aspect of the knee and hinder side of thighs and anal region dark marbled; limbs indistinctly cross-barred; white beneath, the throat and chest slightly dusted with light brown.

No palatine.

Distribution. Southern and Central India, Ceylon, and Assam.

Rao* has stated that he considers Ferguson's description of the tadpole of this species to be really that of a tadpole of *M. ornata*, and, after describing and figuring a tadpole of

* Rec. Ind. Mus. xi. 1915 p. 31.

M. rubra, enumerates a number of points in which his observations differ from Ferguson's. These differences are in colour and transparency, probably features which are variable, and in the following morphological characters:—The position of the nostrils relative to the eyes and the end of the snout, the direction of the spiracular opening, and the position of the anus relative to the spiracle. The British Museum possesses a developmental series (five specimens), collected by Ferguson at Trevandrum in 1903, which probably formed part of the material on which his description was based, and these specimens are undoubtedly *M. rubra*. Comparison of this material with Rao's description and figure shows that the differences which he finds are due to misunderstandings and faulty interpretation; considering the alleged differences *serialim*:—

(a) Ferguson states that the nostrils are nearer the eyes than the end of the snout, whereas Rao maintains that the converse is true, the distance between nostril and eye being $1\frac{1}{2}$ mm. greater than the distance between the nostril and the end of the snout; actually, as Rao's figure shows, the distance of the nostrils from the straight line connecting the anterior border of the eyes is less than their distance from the end of the snout; the distance between nostril and eye, measured diagonally, is, however, greater than the distance of the nostril from the end of the snout.

(b) The direction of the spiracular opening, stated by Ferguson to be "backwards and downwards" and by Rao to be "backwards," scarcely seems worthy of consideration; the amount of food in the intestine will alter the contour of the belly and so affect the direction of the spiracular tube.

(c) The anus, according to Ferguson, is close to the spiraculum; Rao describes it as "slightly sinistral, inconspicuous, covered over by the lower tail lobe," and figures it as present on the lower caudal membrane vertically beneath the hinder side of the thighs. Actually it lies close to the spiraculum, the anal tube being reflected forwards beneath the body and opening where the lower caudal crest joins the body. In this position Rao figures an "abdominal pore," which he asserts there is reason for believing to be a secondary spiracle, further stating that "water comes out in two streams as may be experimented with carmine solution." Such a secondary spiracle is not known in any other tadpole, and Ferguson's material shows no such structure. The explanation seems to be that in tadpoles which are about to metamorphose, and Rao's figure appears to be of such a specimen, just before the arms break through, the adult

anus becomes functional and the external larval anal tube degenerates, leaving the lower caudal crest unattached to the body of the tadpole except at its lower edge; where this lower edge fuses with the body the larval anus persists, and this may represent the so-called "abdominal pore." Injection of a preserved specimen has, however, failed to show any connection between this persistent anus and the spiracular cavity.

Microhyla inornata, Boulenger.

- Microhyla inornata*, Boulenger, Proc. Zool. Soc. London, 1890, p. 37; id. Ann. Mus. Genova, (2) xiii. 1893, p. 342; Boettger, Zool. Anz. 1893, p. 430; Flower, Proc. Zool. Soc. London, 1899, p. 905; Laidlaw, Proc. Zool. Soc. London, 1900, p. 887; Werner, Zool. Jahrb., Syst. xiii. 1900, p. 502; Butler, Journ. Bombay Nat. Hist. Soc. xv. 1904, p. 388; Van Kampen, Zool. Jahrb., Syst. xii. 1905, p. 713; Boulenger, Fauna Malay Penin., Rept. & Batr. p. 259 (1912); Smith, Journ. Nat. Hist. Soc. Siam, ii. 1913, p. 109; Van Kampen, Amph. Indo-Austr. Arch. p. 153 (1923); Smith, Rec. Ind. Mus. xxvi. 1924, p. 141 (tadpole); Nieden, Das Tierreich, Anura, ii. p. 33 (1926); Sambon, Ann. Trop. Med. & Parasit. xxii. 1928, p. 85 (parasites).
 ? *Microhyla stejnegeri*, Boulenger, Ann. & Mag. Nat. Hist. (8) iv. 1909, p. 494; Stejneger, Proc. U.S. Nat. Mus. xxxviii. 1910, pp. 92, 95.
 ? *Microhyla stejnegeri*, Nieden, Das Tierreich, Anura, ii. p. 35 (1926).

Habit moderately stout. Snout blunt, slightly prominent, as long as or slightly shorter than the diameter of the eye; interorbital space broader than the upper eyelid. Digits terminating obtusely, but without any circular or median groove; first finger shorter than the second; toes free or with the slightest rudiment of web; subarticular tubercles strongly developed; a moderately developed inner, but no outer, metatarsal tubercle; tibio-tarsal articulation reaching to between the shoulder and the eye. Skin smooth above and below. Coloration very variable; purplish grey to light brown above, immaculate or spotted with darker; the spots may be small and scattered or large, irregular, or arranged in longitudinal series; sometimes the spots run together to form an irregular reticulum; a dark streak from the end of the snout through the eye and along the flanks usually more or less indicated; upper lips usually light-spotted; limbs usually coloured like the back, sometimes pinkish; white beneath, more or less spotted or marbled with pale brown.

No palatine; palatine region co-ossified with the ethmoid, the ossification extending laterally to the outer borders of the choanæ.

Distribution. Formosa (?), Burma, Siam, Cochin-China, Malay Peninsula, and Sumatra.

I have been unable to find any characters by which to separate *M. steinegeri*, Boulenger (types examined), from this species; it may be that the range of *inornata* is considerably greater than is at present known, or that the locality, Formosa, attributed to the type-specimens of *M. steinegeri* is erroneous, or that there really are two species so closely allied as to be almost indistinguishable; further exploration in S. China and Formosa alone can settle this point satisfactorily; for the present it has been considered advisable to refer *M. steinegeri* to the synonymy of *M. inornata* with a ?.

LXIV.—*Thalassema neptuni*, Gaertner—a British Echiuroid.
By W. HAROLD LEIGH-SHARPE, M.Sc. (Lond.), Lecturer
in Zoology, Chelsea Polytechnic, London.

[Plates XIV. & XV.]

Material and Habitat.—*Thalassema neptuni* occurs: (a) In Plymouth Sound, in borings in limestone made by the mollusc *Saxicava*; and abundant specimens were collected by the author in such borings while dredging in Millbay pits on June 6, 1927. Most of these were small, but one, markedly larger than the rest, is drawn to scale in Pl. XIV. fig. 1, and forms the basis of this description. I did not notice any thick layer of tenacious viscid mucus round the body, which, it is stated, is secreted round it in this situation.

(b) On the shores of Devon and Cornwall in the littoral zone, between tide-marks; and some very large specimens were there collected at Looe on May 25, 1928 (Pl. XV. fig. 9). These were dissected immediately after death and gave valuable confirmation to the original results.

Literature.—The magnificent monograph of Greef (Acta Ac. German, Halle, xl. pt. ii. no. 1, 1879) does not consider this British species; while Rietsch (Recueil. Zool. Suisse, iii. 1886, p. 313) deals only with its histology.

Anæsthetisation.—The living animals were placed at the bottom of a beaker containing sea-water to the depth of four inches, upon the surface of which were sprinkled flakes of menthol. After 12 hours they were found to be completely anæsthetised. During the first hours the animals from the two different habitats (a) and (b) above exhibited markedly different behaviour. Those from (a) showed lively

movements, continually expanding and contracting the prostomium, and vomiting huge quantities of limestone mud at the mouth and defæcating cylindrical pellets of conglomerate limestone mud dotted with arenaceous or flinty granules like currants in a pudding (Pl. XIV. fig. 7), whilst those from (*b*) showed hardly any movement, did not evacuate at either end, and were much more completely extended (Pl. XV. fig. 9). Upon dissection the animals (*b*) had the entire alimentary tract empty, as far as I could see, while those from (*a*) had the rectum still containing some faecal pellets. Both groups of animals, but especially (*a*), showed continuous and rapid colour-changes from pale sandy yellow or buff to pink, deep crimson, and purple very beautiful to behold, and at death these colours are characteristic of certain zones.

Killing and Fixing.—If the anaesthetised animals be placed in 70 per cent. alcohol, they will at once contract and be killed in the short, fat, curved cucumber-like shape usually figured, and the edges of the prostomium will be frilled or crenated (Pl. XIV. fig. 1). But if the animals be first killed by placing them in 4 per cent. formalin for five minutes and then transferred to the alcohol, if desired, they do not contract but remain in the fully-extended condition, when it may be seen that the prostomium can be extended to a much greater length than the body (Pl. XV. fig. 9). I suggest, however, that the animals be kept in the formalin. The brilliant colours will gradually dissolve out in 12 hours in either preservative.

Dimensions.—It thus appears that the size and proportions of the body may vary with the habitat and certainly with the method of killing. Thus the largest animal collected at (*a*) and killed in alcohol has body 3 cm. in length and prostomium 2.1 cm. (Pl. XIV. fig. 1), while the largest animal from (*b*) killed in formalin has body 3.7 cm. in length and prostomium 5.25 cm. (Pl. XV. fig. 9).

The *Prostomium* can evidently be drawn out to great length, as Rietsch describes in *Bonellia minor*. It is well supplied with nerves and highly sensitive, and used for exploring the nature of the bottom. In addition to being an efficient locomotor organ, it is used for the prehension of food. It is ciliated, especially in the groove, setting up simple currents towards the mouth. I have already stated that the animals (*a*) were much more lively in captivity than (*b*), notwithstanding that the latter seemed starving and the former gorged with mud. While (*b*) rarely moved

(a) seemed to be searching for crevices in which to hide, and it was not difficult to prove that they enter a limestone-boring prostomium first, by means of contractions of the body. They then turn round immediately in the hole, using the prominent chaetæ for leverage, the prostomium passing the body, and protruding from the cavity. Rietsch states that if the prostomium is cut off near the mouth *Bonellia* does not long survive, but if a considerable portion is left the scar heals and the lost part is regenerated.

The prostomium (usually miscalled "proboscis," but, now that the Echiuroidea have been established as an order of the Polychæta, approximating to the Sternaspidæ—since it is obviously homologous with the prostomium of the Polychæta it may as well be called such) is not bifurcated at the apex, which is pointed, and cannot be completely retracted—neither is it an introvert.

The *Body* is divisible, in addition to the prostomium, into three well-marked zones or regions externally, which appearance is not accidental to the mode of killing, since they are not well seen in the animal when alive, moving, and unicolorate, or when killed in formalin, but well-marked in contracted alcohol-killed specimens (cf. *Synapta*), but correspond very well to the three divisions of the alimentary canal internally, though there are no septa. I will not at present name these regions, though they are easily comparable to the three regions obvious in *Sternaspis*, and a comparison of these animals I hope to publish shortly. When the animals are alive and undisturbed they are unicolorate and the regions indistinguishable, but on the least irritation the colour-changes will demarcate the regions, the anterior remaining sandy to buff, the middle pink to crimson, the posterior red to purple, waves or blushes of colour flowing antero-posteriorly, familiar to most observers in Cephalopods, e.g., *Sepiolo*.

The *anterior region* bears ventrally immediately behind the mouth one pair of large chaetæ (Pl. XIV. figs. 1 & 2), each of which is a stout incurved chitinous hook embedded in a pocket-like chaetal sac well supplied with motor muscles and obviously an invagination of the epidermis (Pl. XIV. fig. 3). The mouth is anterior, circular, at the base of the ciliated groove of the prostomium. This region, which occupies more than half the length of the body and contains the coiled part of the intestine, has its skin rough, due to slightly elevated polygonal areas.

The *middle region* is very rough externally due to the

greater elevation of the polygonal areas. This is the region of the deepest coloration after irritation or death.

The *posterior region* is smooth and well marked in a contracted specimen. The anus is terminal and may appear invaginated as a star-shaped slit (Pl. XIV. fig. 1), or evaginated in a much-extended specimen. There are no perianal chaetæ.

The *Skin* is tough and raised into polygonal areas visible without a lens in the middle region (Pl. XIV. fig. 1) and with a microscope in the anterior region (Pl. XIV. figs. 3 & 4). Around the margins of these areas are chromatophore cells each containing a black pigment spot. The expansion and contraction of these chromatophores bring about the colour-changes previously mentioned. The cuticle is thin and transparent, and the epidermis is modified into gland-cells. Below this is a layer of longitudinal muscles followed by a layer of circular and oblique fibres.

The *Cœlomic Fluid* is of a dark brown colour, due to its containing numerous spherical corpuscles deeply impregnated with granules of a brown pigment and possibly hæmoglobin. These are easily seen in the cœlom of an animal dissected immediately after death.

The *Alimentary Canal* is divisible into three regions (Pl. XIV. fig. 5) corresponding to the three regions of the body.

The *anterior region*, or small intestine, is transparent, thin-walled, and arranged in irregular coils supported by obvious muscular strands which run from the body-wall. The anterior end, or œsophagus, into which the mouth opens is only slightly dilated and hardly to be distinguished from the remainder. There is a ciliated groove running along one side of the intestine. I have not been able to make out the collateral intestine (siphon).

The *middle region*, or large intestine, is opaque with thicker walls. It is convoluted, but not in regular coils, and contains the faecal pellets (Pl. XIV. fig. 7). Evidently it is water-absorptive.

The *posterior region*, or rectum, is straight and thick-walled. Into its posterior end the anal vesicles open. The anus is terminal.

There is one pair of large *Anal Vesicles*, which unite posteriorly before entering the rectum (Pl. XIV. fig. 5). Their anterior end is convoluted, but after dissecting dozens of large specimens I am satisfied that there is no internal opening into the cœlom such as is described in other genera

and species, neither do the vesicles branch. Their walls are opaque and as thick as those of the rectum.

The *Blood* is not colourless, as stated by Lankester, for on dissecting a freshly-killed specimen the blood-vessels can easily be made out owing to their deep crimson colour.

The *Blood-vascular System* (Pl. XV. fig. 10) consists of a dorsal contractile vessel running along the anterior part of the small intestine only, and called the *intestinal vessel*. This is continued along the dorsal edge of the prostomium as the *dorsal prostomial vessel* to its apex where it bifurcates into two *lateral prostomial vessels*, which run respectively posteriorly along the crenated edges of the prostomium to its base, where, having encircled the œsophagus, the two unite and continue as a *ventral vessel* which runs along the dorsal surface of the nerve-cord and eventually ends blindly. A *parietal vessel* passes from the ventral vessel, encircles the intestine, and opens into the posterior end of the dorsal vessel (Pl. XIV. fig. 5 and Pl. XV. fig. 10).

The *Nervous System* (Pl. XV. fig. 10) consists of a ventral cord lying in the cœlom, but attached to the body-wall (Pl. XIV. fig. 5) and a circumœsophageal ring. With the elongation of the prostomium this collar has become drawn out and the two branches run along the sides of the prostomium and unite at the tip. There are no ganglia and no special sense-organs. The ventral cord gives off paired nerves at regular intervals which encircle the body and uniting dorsally form rings in the skin and in the prostomium.

The *Gonads* (Pl. XIV. fig. 5) are developed from cœlomic epithelium and appear as masses of gametocytes along the wall of the ventral blood-vessel. The cells break away and float in the body-cavity, so that the cœlomic fluid in my specimens is full of developing ova. The eggs are spherical with one or two refringent areas on the nucleus (Pl. XIV. fig. 6), and not ovoid as is usually stated to be the case in *Thalassema* spp.

There are two pairs of *Nephromixia* in this species situated in the anterior end of the body (Pl. XIV. figs. 5 & 8). Their external openings are ventral, close to the nerve-cord, and just posterior to the bases of the chætal sacs. It is a curious fact that in all the specimens taken by me in May and June all the nephromixia are crammed full of ova which entirely obscures their cœlomic funnels. In only one very large specimen out of many dissected at the British Museum by a colleague were cœlomic funnels visible as figured by

Greef. I hazard the suggestion that this specimen was a male. From my observations two facts seem to be established: (1) the end of May and the beginning of June is the breeding-season in the Plymouth area; (2) females greatly preponderate, which is my usual experience in the Polychæta (*vide* my account of *Tomopteris*, Ann. & Mag. Nat. Hist. ser. 10, vol. i. p. 214).

SUMMARY OF NEW FEATURES IN *THALASSEMA NEPTUNI*.

1. The shape of the body varies according to (a) habitat, (b) method of killing and fixation.
2. The alimentary canal is divided into three regions, which correspond to the three regions of the body.
3. The skin is divided into polygonal areas.
4. The chromatophore cells are arranged along the margins of the polygonal areas.
5. The blood is red.
6. The anal vesicles are unbranched, and do not have an internal opening into the coelom.
7. All the animals taken in May and June proved to be female.
8. The eggs are spherical.
9. Cylindrical faecal pellets are present in specimens from limestone borings, absent from littoral specimens.
10. The end of May and the beginning of June is the breeding-season in the Plymouth area.
11. Females greatly preponderate.

EXPLANATION OF THE PLATES.

PLATE XIV.

Thalassema neptuni.

- Fig.* 1. Entire animal in left lateral aspect. *M.*=position of mouth; *Pr.*=prostomium; *Ch.*=chaetæ; *A.*=anus.
- Fig.* 2. Anterior end in ventral aspect. *Pr.*=prostomium; *M.*=position of mouth; *Ch.*=chaetæ.
- Fig.* 3. Chaetæ.
- Fig.* 4. Polygonal areas of the skin of the anterior end of the body, a high magnification of part of *fig.* 3. *Chr.C.*=chromatophore cells; *P.*=polygonal area.
- Fig.* 5. A dissection of the body from the right side. *M.*=mouth; *N.*=nephromixia; *Ov.*=ovary; *N.C.*=nerve-cord; *A.V.*=anal vesicles; *V.B.V.*=ventral blood-vessel.
- Fig.* 6. Ovum.
- Fig.* 7. Faecal pellets.
- Fig.* 8. Nephromixia. *N.C.*=nerve-cord.

PLATE XV.

- Fig.* 9. An animal with extended prostomium.
- Fig.* 10. The blood-vascular (red) and nervous (green) systems. *D.Pr.V.*=dorsal prostomial vessel; *L.Pr.V.*=lateral prostomial vessels; *Int.V.*=intestinal vessel; *N.C.*=nerve-cord; *P.V.*=parietal vessel; *V.V.*=ventral vessel.

LXV.—New or little-known Gerridæ.—I. *Ceylonese Species.*

By TEISO ESAKI, Department of Agriculture, Kyushu Imperial University, Fukuoka, Japan.

THE material on which the present paper is based was collected by Mr. G. M. Henry in Ceylon in 1926 and 1927, and the types of the new species are preserved in the British Museum, London.

Rheumatogonus vittatus, sp. n. (Fig. 1.)

Body brown, ventral surface much paler. Head brown; posterior margin of vertex, eyes, antennæ except the extreme base of the first segment, and the apex of the third segment and the entire to 10th segment of rostrum black. Pronotum totally brown, meso- and metanotum brown, with a very conspicuous median stripe which is thickest at the middle of mesonotum (not extending anteriorly to the anterior margin of mesonotum in female), and a more or less triangular spot at the lateral portions of the anterior margin of mesonotum black. Legs black, with coxæ, trochanters, base of anterior femur brown, sometimes the anterior femur brown with three black stripes. Posterior margin and lateral surface of metacetabulum black, mesoacetabulum in female with a black spot. Dorsal surface of abdomen brown, very dark and blackish in female, the middle area of first segment obscurely black. Posterior half of the first male dorsal genital segment black. Ventral surface much paler.

Body very slender, cylindrical in male, more or less spindle-shaped in female. Head much longer than broad between eyes at the base, antecular portion much shorter than eyes, apical portion arcuately rounded, posterior margin straight. Eyes much rounded exteriorly, slightly emarginate interiorly and slightly protruded posteriorly from the posterior margin of vertex. Antennæ long and slender, but shorter than body, first segment much the longest, second about three-fifths of first, slightly more slender than first, third slightly longer than second, fourth about two-thirds of third. Ratio of the antennal segments = 38 : 22 : 27 : 19. Rostrum reaching the anterior coxæ, third segment much the longest. Pronotum transverse, exactly two-fifths as long as broad, almost rectangular in shape; mesonotum very long, about twice as long as pronotum, lateral margins very slightly (♂) or distinctly (♀) divergent posteriorly, anterior portion of metanotum about as long as pronotum. Anterior legs

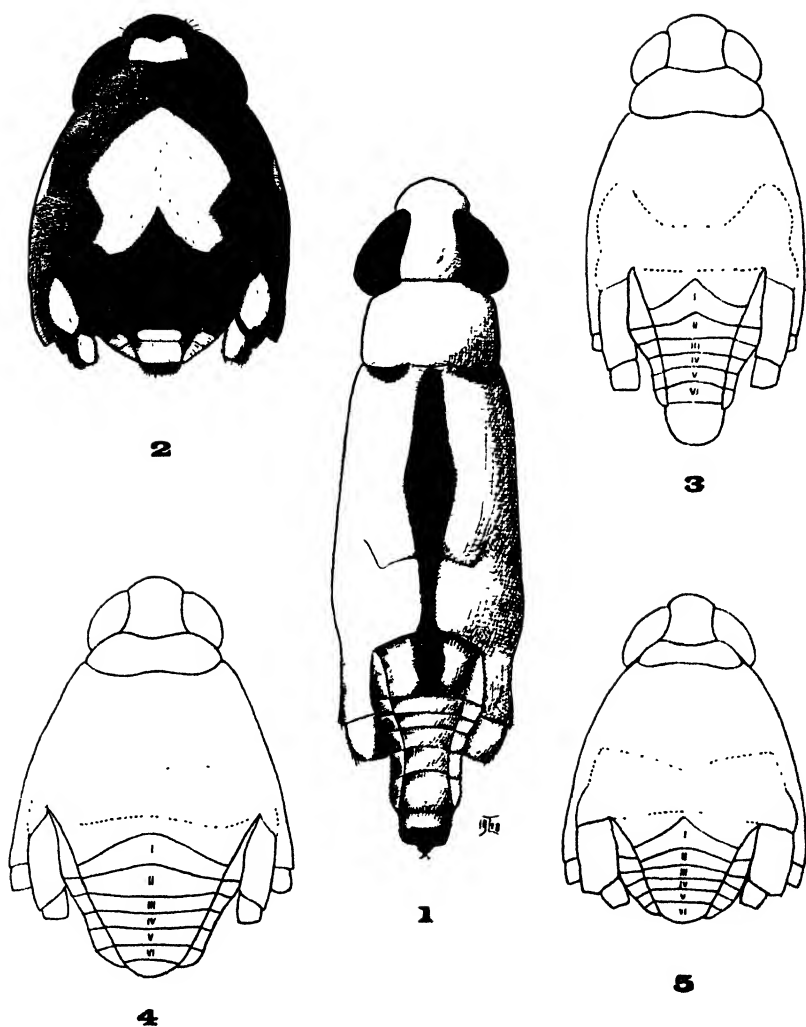


Fig. 1.—*Itheumatogonus vittatus*, sp. n., ♂.

Fig. 2.—*Ventidius henryi*, sp. n., ♂.

Fig. 3.—*Metrocoris stali* (Dohrn), ♂. Semi-diagrammatic.

Fig. 4.—*Eurymetra natalensis* (Distant), ♂. Semi-diagrammatic.

Fig. 5.—*Ventidius aquarius*, Distant, ♂. Semi-diagrammatic.

short, coxa and trochanter very short, a little longer than broad, the latter adorned with six or seven very long stout setæ beneath; femur very long, tapering near the apex; tibia a little shorter and much less stout than femur, projected inwardly at the apex but not acutely; tarsus shorter than half the length of tibia in male, longer in female, first segment a little longer than second. Femur:tibia:tarsus i.: ii. = ♂ 62:50:9:7, ♀ 75:55:16:13. Intermediate and posterior femur equal in length, much longer than body, the former stouter than the latter; intermediate tibia little longer than half of femur, much more slender, with a fringe of long hairs on the apical two-thirds; tarsus not longer than half the length of tibia, first segment more than five times as long as second; posterior tibia about a quarter of the femur, very slender, tarsus very short, not longer than one-tenth of tibia, two segments of equal length. Metacubicular suture very long. Abdomen rather small, tergites very narrow, constricted at the middle in male, narrowest at the fourth and fifth segments; first segment more or less confluent with the posterior portion of metanotum, about as long as broad, second and third nearly equal in length, fourth a little longer than third, fifth a little longer than fourth, sixth very long, more than fourth and fifth put together, lateral margins divergent posteriorly, first male genital segment as broad and long as the sixth dorsal abdominal segment, posterior margin truncate. Male ventral abdominal segments very narrow, first four segments very short, fifth a little longer, sixth very long, about as long as four preceding segments taken together, posterior margin concavely sinuate; first male ventral genital segment very short, second segment very long, parameres hook-like. Connexivum very broad, obliquely erect. In female abdomen broader than in male, genital segments small.

Length of body, ♂ 4.5 mm., ♀ 5.5 mm.; breadth of body, ♂ 1.2 mm., ♀ 1.5 mm.; length of intermediate femur, ♂ 6 mm., ♀ 7.5 mm.; length of intermediate tibia, ♂ 3.5 mm., ♀ 4.5 mm.; length of posterior femur, ♂ 6 mm., ♀ 7.5 mm.; length of posterior tibia, ♂ 1.5 mm., ♀ 2 mm.

Macropterous form is unknown.

Hab. Ceylon.

Holotype (♂), paratopotypes (two teneral ♀ ♀), Kitulgala, Ceylon, April 12th, 1927 (G. M. Henry).

The above description is mostly based on the male specimen, as the females are teneral.

R. villatus is much smaller than any other known species

of the genus. The male is very slender and with a very conspicuous black stripe on meso- and metanotum. The anterior tarsus in male is shorter than half of tibia, and this may require a slight alteration of the generic diagnosis of *Rheumatogonus*.

Onychotrechus sakuntala (Kirkaldy).

Gerris sakuntala, Kirkaldy, Entomologist, xxiv. p. 117 (1901).

Onychotrechus sakuntala, Distant, Faun. Brit. Ind., Rhynch. ii. p. 183 (1904).

Onychotrechus vadda, Distant, Ann. & Mag. Nat. Hist. (8) v. p. 144 (1910); Faun. Brit. Ind., Rhynch. v. p. 146, fig. 79 (1910), **syn. nov.**

Three male macropterous specimens, Kitulgala, 9. iv. 1927, are in the collection. *Onychotrechus sakuntala* (Kirkaldy) was very poorly described from the winged form as belonging to *Gerris*, subgenus *Limnometra*. *O. vadda*, Distant, described from the apterous form, is identical with this species.

As I have mentioned already *, *Onychotrechus*, Kirkaldy, and *Amemboa*, Esaki, exhibit some resemblance, but these two genera are well separated as follows:—

Onychotrechus, Kirkaldy.

1. Body oblong, more than four times as long as broad.

2. First segment of antennæ longest.

3. Rostrum very long, protruding to the middle of mesosternum, third segment extremely long.

4. No sexual difference in the anterior legs.

5. Intermediate femur longer than tibia and tarsus together.

6. Intermediate tarsus very short, shorter than a quarter of tibia, first tarsal segment not longer than a half of second, claws almost apical, as long as first tarsal segment.

7. Posterior tarsus very short, shorter than a quarter of tibia, first segment about a half of second, claws as in intermediate legs.

Amemboa, Esaki.

1. Body rather oval, not more than three times as long as broad (hemelytra in winged form are not concerned).

2. Fourth segment of antennæ longest.

3. Rostrum much shorter than in *Onychotrechus*, a little passing the anterior coxæ.

4. Anterior femur in male stouter than in female and armed with processes.

5. Intermediate femur shorter than tibia and tarsus together.

6. Intermediate tarsus longer than a half of tibia, first tarsal segment longer than twice the second, claws almost apical, very short.

7. Posterior tarsus about two-thirds of tibia, first segment longer than second, claws as in intermediate legs.

* Ann. Mus. Nation. Hungar. xxiii. p. 122 (1926).

The following species of these genera are known :—

1. *Onychotrechus sakuntala* (Kirkaldy), 1910 = *O. vadda*, Distant, 1910.
Ceylon, ? Burma.
2. *Onychotrechus rhexenor*, Kirkaldy, 1903 (type).
S. India.
3. *Amemboa kumari* (Distant), 1910.
S. India.
4. *Amemboa lyra* (Paiva), 1918.
Burma.
5. *Amemboa fumi*, Esaki, 1925 (type).
Formosa, Philippines, Sumatra.
6. *Amemboa horváthi*, Esaki, 1926.
Annam.

Amemboa kumari (Distant) and *A. lyra* (Paiva) were described as belonging to *Onychotrechus*. I have seen the type of the former, and, judging by the good figure of the latter, there is no doubt that both the species belong to *Amemboa*.

The genus *Eotrechus*, Kirkaldy, is most closely allied to *Onychotrechus*, Kirkaldy*, but it is more oblong in shape, apparently very similar to certain forms of the *Gerris* group: eyes distinctly emarginate; intermediate and posterior femora are shorter than the corresponding tibia and tarsus taken together; intermediate and posterior tarsi are very short, first segment is not or only a little shorter than the second, and differs also in some other characters. Intermediate and posterior tarsi in both the genera are with very long claws, and in *Eotrechus* they are furnished with a very long pulvillus between them, being described by Kirkaldy as "aroliated."

Ventidius henryi, sp. n. (Fig. 2.)

Body above black, with sordid yellow marking, beneath sordid yellow. Head black, with a broad transverse band at

* See Bergroth, Journ. Bombay Nat. Hist. Soc. xxiv. no. 1, p. 179 (1915).

the base of vertex and the lateral portions of frons sordid yellow. Eyes black, more or less shining; antennæ black, with the base of the basal segment sordid yellow. Rostrum black, with the second segment sordid yellow. Pronotum totally black; mesonotum black, with a stripe on each pleural portion and a large, rather irregular-shaped central spot, which is more or less variable in shape and size, but generally convexly protruded anteriorly and concavely sinuated posteriorly, sordid yellow; metanotum totally black, with a large oblong spot on metacetabula sordid yellow. Ventral surface of thorax totally sordid yellow. Legs black, with the anterior coxa and trochanter, intermediate and posterior coxæ obscurely yellowish. Dorsal surface of abdomen black, with the middle portion of last two abdominal and first genital segments except the posterior margin sordid yellow. Ventral surface of abdomen totally sordid yellow, but the genital segments much darker. Connexivum sordid yellow, with the exterior margin and posterior margin of each segment black.

Body much rounded, very convex dorsally. Head with eyes much broader than long. Vertex with the lateral margins almost straight and parallel, much rounded anteriorly. Eyes strongly protruded posteriorly, covering entire pronotum and reaching the humeral angles of mesonotum. Antennæ slender, first segment a little stouter than the rest, slightly curved near the base; second, third, and fourth segments nearly equal in length. Ratio of the antennal segments = 50:20:20:20. Rostrum reaching the anterior coxæ. Pronotum very short, shorter than half the length of head, lateral margins totally covered by eyes, anterior margin slightly concavely sinuate, posterior margin a little more concavely sinuate; meso- and metanotum apparently fused, boundary suture rather obscure. Anterior legs short, femur a little curved near the base, tibia more slender and slightly shorter than femur, tarsus shorter than half the length of tibia, first segment very small, not longer than one-fourth of second, claws inserted at the middle of second. Intermediate and posterior legs very long and slender, tapering towards the apex. Intermediate femur much longer than body, tibia about three-fifths of femur, tarsus about three-fifths of tibia, first segment nearly five times as long as second. Posterior femur longer than intermediate one, tibia shorter than a half of femur, tarsus very short, about one-third of tibia, two segments of equal length. Femur:tibia:tarsus=85:50:35 (intermediate leg) and 90:35:15 (posterior leg). Metacetabulum long and obliquely truncate.

Abdomen very short and small, much narrowed posteriorly, nearly triangular in shape, connexivum rather wide and erect. Genital segments very small.

Length of body, ♂ 2.4 mm., ♀ 2.2 mm.; breadth of body, ♂ 1.8 mm., ♀ 1.6 mm.

Hab. Ceylon.

Holotype (♂), paratopotypes (3 ♀ ♀), Kitulgala, 12. iv. 1927 (G. M. Henry).

This species is much smaller than the two known species of the genus—*Ventidius aquirius*, Distant, and *V. distanti*, Paiva,—and differs also in the three apical segments of the antennæ. The coloration is very similar to that of *Ventidius distanti*, Paiva, but the black area is more pronounced. This species is dedicated to the collector, Mr. G. M. Henry, of the Colombo Museum.

The genus *Ventidius* was described by Distant* from Travancore, S. India. Although this genus is quite distinct from *Metrocoris*, Mayr, it was treated by Bergroth† as identical with the latter, as the description by Distant is very insufficient. Bergroth states that “the differential characters given by Distant, ‘body shorter and broader, and hirsute antennæ,’ are only specific.” This genus is allied to *Metrocoris*, Mayr, and *Eurymetra*, Esaki‡, but these three genera can be distinguished by the following characters in the apterous form:—

1. *Metrocoris*, Mayr, 1865 (= *Halobatodes*, B. White, 1883, *Metrocoropsis*, Paiva, 1919). (Fig. 3.)—Body more or less oblong, oval or stout spindle-shaped, dorsal surface generally opaque, abdomen narrow, tergites together much longer than broad, male genital segments large and conspicuous, with strong hook-like parameres. Eyes protruded postero-laterally, but not passing the middle of pronotum. Male anterior femur generally much stouter than that of female, sometimes furnished with spine-like processes. Meso- and metacubulum almost vertical in position. Metanotum much shorter than mesonotum, suture between them straight at the middle, anteriorly bending at the lateral portions, metanotum divided into two portions transversely by a straight suture, posterior margin strongly anteriorly

* Ann. & Mag. Nat. Hist. (8) v. p. 149 (1910), and Fauna Brit. Ind., Rhynch. v. p. 156 (1910).

† Ann. Soc. Ent. Belgique, lx. p. 186 (1911).

‡ Described as a subgenus of *Metrocoris* (Ann. Mus. Nation. Hungar. xxiii. p. 129 (1926)).

sinuate, forming a right angle at the middle. (Southern and Eastern Asia, Malayan Archipelago, always found on small streams. Type, *Metrocoris stali* (Dohrn), Ceylon.)

2. *Eurymetra*, Esaki, 1926. (Fig. 4.) Body much broader than in *Metrocoris*, more or less shining, dorsal surface almost flat, abdomen much broader, tergites together nearly as long as broad, male genital segments small. Eyes more extended postero-laterally than in *Metrocoris*, but not reaching the mesonotum. No sexual difference in the anterior femur; mesoacetabulum infero-lateral to the metacetabulum. Metanotum a little shorter than mesonotum, suture between them straight at the middle, slightly (much less than in *Metrocoris*) bending anteriorly at the lateral portions, metanotum divided into two portions transversely by a slightly anteriorly sinuate suture, posterior margin moderately anteriorly sinuate, but not forming an angle at the top. (Africa, found on stagnant waters. Type, *Eurymetra natalensis* (Distant), South and East Africa.)

3. *Ventidius*, Distant, 1910. (Fig. 5.) Body much broader than in *Metrocoris*, more or less shining, dorsal surface conspicuously convex; pronotum very small, not longer than half the length of head, abdomen very broad as in *Eurymetra*, male genital segments very small. Eyes strongly protruded postero-laterally, covering the whole lateral margins of pronotum and further extending on to the humeral angles of the mesonotum*. No sexual difference in the anterior femur; mesoacetabulum infero-lateral to metacetabulum as in *Eurymetra*. Intermediate and posterior legs rather short, strongly tapering towards the apex, especially the tibiae and tarsi. Metanotum a little shorter than mesonotum, suture between them posteriorly sinuate at the middle but sometimes very faint and scarcely visible (not accurately shown in Distant's and Paiva's figures), metanotum divided into two portions by an anteriorly slightly sinuate transverse suture, posterior margin strongly anteriorly sinuate, forming a right angle at the top. (India, Ceylon, Burma, and Malay Peninsula, probably found on small streams. Type, *Ventidius aquaticus*, Distant, South India and Malay Peninsula.)

* Distant's figure (Faun. Brit. Ind., Rhynch. v. p. 156, fig. 84 (1910)) is not correctly delineated on this point. See Paiva's figure of *Ventidius distantii*, Paiva (Rec. Ind. Mus. xiv. pl. viii. fig. 4 (1918)).

Halobates flaviventris, Eschscholtz.

Halobates flaviventris, Eschscholtz, Entomographien, p. 109, tab. ii. (1822); Burmeister, Handb. Ent. ii. p. 209 (1835); Herrich-Schäffer, Wanz. Ins. viii. p. 110 (1847); B. White, Rep. 'Challenger,' Zool. vii. pt. 19, p. 55, pl. ii. fig. 2 (1883); Distant, Faun. Brit. Ind., Rhynch. ii. p. 188 (1904).

Halobates herdmani, Carpenter, Ceylon Pearl Oyster Report, London, v. p. 151, pl. figs. 1-19 (1906); Distant, Faun. Brit. Ind., Rhynch. v. p. 153 (1910), **syn. nov.**

Specimens (4 ♂♂, 1 ♀) from Barbaryn Island, xii. 1926, are in the collection. This species was originally described by Eschscholtz from the South Atlantic Ocean, but the type has apparently never been studied since, and may be lost at present. In his monograph of the pelagic Hemiptera B. White described this species based on two specimens from St. Helena and Ceylon respectively. Carpenter afterwards described a *Halobates* from Ceylon as *H. herdmani*, Carpenter. The chief difference between *flaviventris* and *herdmani* given by Carpenter is the striking asymmetry of the "horns" in the male genital segments. In *herdmani* the left-hand horn is strongly outwardly divergent from the axis of body, presenting a transitional stage to *H. micans*, Eschscholtz, in which the same is almost perpendicularly directed from the axis of body. However, this character is apparently present also in *Halobates flaviventris* auct., and although White did not describe it in words, he showed it very distinctly in his figure (*loc. cit.* pl. ii. fig. 2 g). White examined specimens from St. Helena and Ceylon when he described the species, and there is practically no doubt that his Ceylonese specimen and *Halobates herdmani*, Carpenter, belong to the same species. As the type of *H. flaviventris*, Eschscholtz, has not been located since it was described, I have assumed that the single male specimen from St. Helena studied by White, now preserved in the Zoological Museum of the University in Berlin, belongs to this species, of which type-locality is the South Atlantic Ocean. After a careful examination of this specimen I have come to the conclusion that it is specifically identical with the Ceylonese specimens, as the characters of the anterior tarsi and the male genital segments are exactly identical. Thus, I have synonymized *H. herdmani*, Carpenter, with *H. flaviventris*, Eschscholtz.

Halobates flaviventris, Eschscholtz, var. *kudrini*, Nasonov, 1893, from India, is apparently specifically distinct from *H. flaviventris*, Eschscholtz.

LXVI.—*A Contribution towards the Insect Fauna of French Oceania.*—Part III. Formicidæ. By L. EVELYN CHEESMAN, F.E.S., F.Z.S., and W. C. CRAWLEY.

THE following collection of ants was made by one of us in 1925 upon four of the Marquesan islands and Faka-rava (an atoll of the Tuamotu Archipelago) while a member of the 'St. George' Expedition; and also upon the Society Islands, Tahiti, Raiatea, and Bora Bora in the same year after leaving the expedition.

The ants of these islands have not previously been worked out, one species only—*Lasius claviger*—being recorded from Tahiti. The list of species numbers twenty-five—Ponerinæ two, Myrmiciniæ thirteen, Dolichoderinæ three, Camponotiniæ seven. Of these, seven species are tropical forms with a wide distribution, being carried everywhere by commerce, and occurring throughout the majority of island groups of the Pacific—*Pheidole megacephala*, F., *Monomorium floricola*, Jerd., *Solenopsis geminata*, var. *rufa*, Jerd., *Anoplolepis longipes*, Jerd., *Tetramorium simillimum*, Sm., *T. guineense*, F., and *Technomyrmex albipes*, Sm. The remaining species belong to an oceanic subfauna including one new island race.

Records of these species from other island groups are added, and for the remainder of their synonymy, when this is lengthy, reference is given to Emery's monographs in the 'Genera Insectorum.'

Ants were extremely abundant upon all the above islands, especially in the inhabited areas. One species would be usually preponderant, but not always the same species; in some cases the dominant species would differ in different localities of the same island. Upon all those of the Society Islands *Pheidole oceanica nigriscapa*, var. *tahitiana*, sp. n., and *Monomorium floricola* swarmed on the coasts, firmly established as house-ants in all the villages visited. *Pheidole megacephala*, F., held a like position on the Marquesas Islands. On the atoll Faka-rava *Solenopsis geminata*, var. *rufa*, Jerd., was the most abundant about the huts; *Paratrechina bourbonica*, subsp. *bengalensis*, For., although also abundant, was not seen near habitations. On the shores of Tahiti and Bora Bora very large and vigorous colonies of *Solenopsis geminata*, var. *rufa*, Jerd., *Anoplolepis longipes*, and *Pheidole oceanica nigriscapa*, var. *tahitiana*, Santschi, were in close proximity—the last always preponderant. In

other parts of the world the two former species have a name for displacing one another (Wheeler, 'Ants,' p. 155, 1910). Of those species occurring in the interior of the islands *Cardiocondyla emeryi*, For., and *Plagiolepis angusti*, Emery, were taken only on the northern coast-hills of Tahiti, about 2 to 3 miles inland. *Tetramorium pacificum*, Mayr, was taken only on the borders of Lake Vaihira on the same island 8 miles inland, and *Rogeria stigmatica*, var. *sublævinodis*, Em., was taken only at the head of a valley in the centre of N.W. Raiatea.

Although the coast-belts of Tahiti literally swarmed with predaceous species of ants, there was no evidence that they were destroying the local insect-fauna, as one might have supposed to be the case. Insects of all kinds might be found in close proximity to the nests, but were apparently ignored unless special attention was drawn to them. For example, there were prosperous colonies of four species at least of predatory ants around my hut at Patutua, Tahiti, an enormous colony of *Pheidole oceanica nigriscapa*, var. *tahitiana*, sp. n., being established directly under it. A few yards from the hut was an area of ground covered in tangled undergrowth of plants from which I continually collected insects in all stages of growth. Worker-ants explored the entire neighbourhood, and yet numbers of insects could be found near at hand. There can be no supposition of any immunity against ants on the part of such insects, because when I brought any specimens, living or dead, into the hut it was necessary to take special precautions against ants: boxes, table, and shelves had to be periodically soaked in creosote, for no specimen was safe from their scouts. One can only surmise that while ants can exploit human habitations which yield unlimited supplies of concentrated food, they will systematically scour these in preference to hunting for insects.

There is one curious fact to note concerning *Anoplolepis longipes*—that whereas ants of this species were to be found in abundance on coral-protected shores, scavenging on the beach close up to the tide-line, they were never to be seen near the waves on exposed beaches. They were seemingly aware of the danger of being caught by heavy rollers on such beaches, and when present were always well out of reach of the breakers.

PONERINÆ.

1. *Platythyrea pusilla*, Emery, Rev. Suisse Zool. i. p. 188 (1893) (Amboyna); Wheeler, Bull. Mus. Comp. Zool. lxiii. p. 50 (1919) (Borneo).

Society Is.: Tahiti, Patutua, on a tree-trunk near the road, using the same trails as *Paratrechina bourbonica*, subsp. *bengalensis*, For., 1 ♀, 13. iv. 25. Tautira, on Coccids, shore-belt, 1 ♀, 7. viii. 25.

Distribution. Amboyna, Borneo.

2. *Ponera perkinsi*, For. Fauna Hawaii, Formic. i. p. 117 (1899).

Marquesas Is.: Fatu-hiva, Nuku-hiva, ♀ ♀ tending Coccids in the valleys, ♂ ♂ ♂ under bark, Jan. 1925. Society Is.: Tahiti, ♂ ♂ in the sugar-cane fields near Papeete, 13. iv. 25.

Distribution. Hawaiian Is.

MYRMICINÆ.

The following species has been named by Dr. F. Santschi:

3. *Pheidole oceanica* subsp. *nigriscapa*, var. *tahitiana*, sp. n.

Santschi (Ins. Samoa, pt. v. fasc. 1, fig. 3, p. 49 (1928)) refers to the Tahitian variety as differing from the Samoan subspecies in the following characters:—"J'ai reçu dernièrement de Mr. Crawley un ♀ et 2 ♂ ♂ de Tahiti qui appartiennent à *nigriscapa*, mais en différent par la tête encore moins échancrée derrière et les rides plus accusées sur les côtés de la tête." In a letter he proposes the name *tahitiana*.

Society Is.: extremely abundant on the inhabited shore-belts, where workers swarm in the houses and native huts after food. On Tahiti also abundant in the cultivated valleys: at Patutua ♀ ♀ taken on a leguminous tree which had been defoliated by the caterpillars of *Polydesma umbricola*; these were just leaving the branches in order to pupate in crevices of the trunk, and were being attacked by *Polistes macaensis*, var. *tahitiensis*, Chees.; the *Pheidole* workers were gathered in numbers round the base of the trunk, and those caterpillars which were dropped by the wasps were carried off by the ants, 23. iv. 25. Colonies in the sugar-cane fields near Papeete, nests in soil, 1. iv. 25. Vigorous colonies at the

head of a valley above Papeete, at about 1500 ft., near the ruins of a hut. 2 ♂ & ♀ taken at light on the borders of Lake Vaihiria, 8 miles inland, 10. vii. 25. On Raiatea, ♀ ♀ tending Coccids in an earthen shed in the bract of a pepper, 3. vi. 25. ♀ ♀ from nest in rotten wood in dense scrub on a high ridge of the interior, north-east of the island, 7. vi. 25. ♀ ♀ under stones on the sea-shore, 16. 5. 25. On Bora Bora, abundant on a small uninhabited reef-islet, Motu Monte.

4. *Pheidole umbonata*, Mayr, Sitzber. Akad. Wiss. Wien, liii. p. 510 (1866); id. Verh. zool.-bot. Ges. Wien, xx. pp. 977-8 (1870) (Fiji); Mann, Bull. Mus. Comp. Zool. lxiii. p. 316 (1919) (Solomon Is.); id. l. c. lxiv. p. 430 (1921) (Fiji).

Society Is.: Tahiti, ♀ ♀ ♀ sugar-cane fields near Papeete, 1. iv. 25. Raiatea, ♀ ♀ tending Coccids on the sea-shore, 6. vi. 25.

Distribution. Tonga Is., Samoa, Solomon Is., Fiji.

5. *Pheidole megacephala* (F.).

Formica megacephala, F., Ent. Syst. ii. p. 361 (1793) (Mauritius); Wheeler, Bull. Mus. Comp. Zool. lxiii. p. 65 (1919) (Borneo).

Marquesas Is.: Nuku-hiva, Fatu-hiva, Hiva-oo, abundant in inhabited regions, ♂ ♂ ♀ ♀ ♀ ♀ in nests under stones, Jan. 1925.

Distribution. All tropical countries, Samoa, Hawaii, Borneo.

6. *Pheidole oceanica*, Mayr, Sitzber. Akad. Wiss. Wien, liii. p. 510 (1866) (Fiji); id. Verh. zool.-bot. Ges. Wien, xx. p. 977 (1870); Mann, Bull. Mus. Comp. Zool. lxiii. p. 316 (1919) (Solomon Is.); id. l. c. lxiv. p. 436 (1921) (Fiji).

Marquesas Is.: Fatu-hiva, ♀ ♀ on a trail scavenging on the sea-shore, Jan. 1925.

Distribution. Solomon Is., Samoa, Hawaii.

7. *Pheidole* sp. (near *P. umbonata*, Mayr).

Society Is.: Tahiti, ♀ ♀ upon banana-peel near the beach at Papenoo, 6. iii. 25; ♀ ♀ on a lime at Patutua, 1. iv. 25. In the absence of ♀ and ♂, it is impossible to identify this species.

8. *Monomorium floricola* (Jerd.).

Atta floricola, Jerdon, Madras Journ. Lit. & Sci. xvii. p. 107 (1851) (Tellicherry, S. India); Wheeler, Bull. Mus. Comp. Zool. lxxiii. p. 84 (1919) (Borneo).

Society Is. : Tahiti and Raiatea, abundant near habitations on the coast ; on food, sugar, etc. On Raiatea colonies were also established in a valley above the village of Utur a, ♂ ♀ ♀ ♀ from nest under bark, 7. vi. 25. ♀ ♀ on Coccids.

Distribution. Tropical Asia and America, Oceania, Fiji. Hawaii, Borneo, Samoa. Carried upon ships.

9. *Cardiocondyla emeryi*, For. Mittheil. München. Ent. Ver. v. 1, p. 5 (1881) ; Emery, Gen. Ins. Formic. fasc. 174, p. 125 (1921).

Society Is. : Tahiti, on the coast-hills behind Papeete at 1500 ft., 5 ♀ ♀, 1 ♂ in a nest inside a lump of clay, 16. iv. 25 ; 5 ♀ ♀ among bracken in the same locality at 2500 ft., 17. iv. 25.

Distribution. Antilles, Madeira, Syria.

10. *Solenopsis geminata*, subsp. *rufa* (Jerd.).

Atta rufa, Jerdon, Madras Journ. Lit. & Sci. xvii. p. 106 (1851) (Malabar) ; Emery, Gen. Ins. Formic. fasc. 174, p. 197 (1921).

Tuamotu Arch. : Faka-rava, abundant on the beach feeding upon dead molluscs, 11. ii. 25. Society Is. : Tahiti and Raiatea, abundant on the shore-belts ; on Tahiti, inland on the coast-hills behind Papeete at 1500 ft., nests with large mounds not far from the ruins of a hut, 11. vii. 25 ; in Fautau Valley, about 6 miles inland, nest with mound, 2. viii. 25. On Raiatea galleries under the bark of a dead branch of *Hibiscus tiliaceus* on the shore contained stored seeds ; when the bark was removed workers carried the seeds to other chambers higher up the branch, 8. vi. 25. Workers constructing covered ways of soil across a road with entrances at intervals. The subway followed an almost straight line, and when occasionally it was blocked by a stone or other obstacle the tunnel would be continued under it, 30. v. 25. The method adopted by these ants of making such subways has been described by Rothney (Trans. Ent. Soc. p. 366 (1889)). Nests are in soil, either with mounds or at the roots of trees, under stones, etc. Food various, dead animal matter, living

insects, exudations of Coccids and Aphids. Workers came to sugar in my hut, and also demolished a dead lizard in less than an hour, leaving only the skeleton and portions of the skin. This species is very pugnacious, and the sting painful (it is known as the fire-ant). The soldiers are not usually seen with the other workers above ground, but will be found in the lower galleries of the nest; they appear to be of a timid temperament, and, unlike their fierce nest-mates, will not show fight, but only attempt to escape.

Distribution. India, Malaya, Hawaiian Is., Borneo, New Guinea. (Not found by Mann on the Solomons or Fiji.)

11. *Rogeria stigmatica*, subsp. *sublevinodis*, Emery, Nova Caledonia Zool. i. p. 415 (1914); Mann, Bull. Mus. Comp. Zool. lxiv. p. 451 (1921) (Fiji).

Society Is.: Raiatea, in the interior of the northern end of the island, at the head of a gully at 2000 ft. in dense scrub. Series of ♀♀ and portion of the nest which was in a rotten log with extensive galleries and several roundly excavated chambers containing soldiers, 28. v. 25.

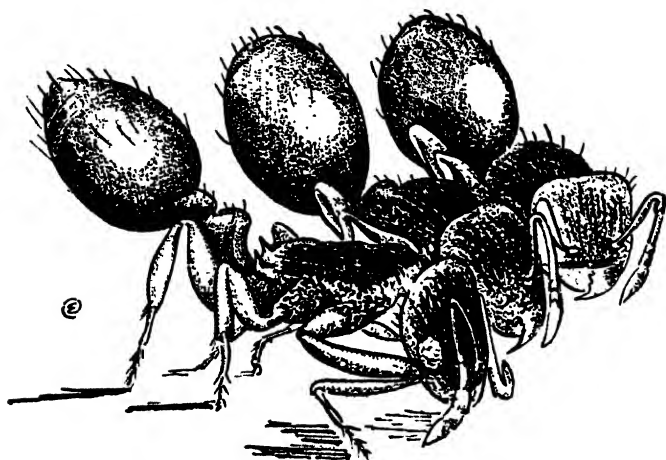
Distribution. New Caledonia, Loyalty, Fiji, Samoa.

12. *Tetramorium simillimum* (Sm.).

Myrmica simillima (Nylander), Smith, List Brit. Anim. B.M. p. 6, Acul. p. 118, 1851 (Dorsetshire, England, in a hot-house); Wheeler, Bull. Mus. Comp. Zool. lxiii. p. 91 (1919) (Borneo); Emery, Gen. Ins. fasc. 174, p. 278 (1921); Mann, Bull. Mus. Comp. Zool. lxiv. p. 459 (1921) (Fiji).

Society Is.: Tahiti. A nest in soil at the roots of a coconut-palm near my hut; the workers carried off insects which singed themselves at my lamp in the evening; they appeared immediately it was lighted, and waited for victims, remaining as long as the lamp was alight, which was sometimes until 2 A.M. They were extremely troublesome, because of their attempts to take my specimens, even removing them from the pins, 12. iv. 25. ♀♀ carrying away mutilated specimens of the caterpillars of *Polydesma umbricola* dropped by *Polistes*, 8. v. 25. On Bora Bora, while collecting on the shore I put out a small piece of sardine on a rock to attract ants or flies. Almost immediately it was found by a worker of *Pheidole oceanica nigriscapa*, var. *tahitiana*, which carried away a portion. On examining the sardine a few minutes later I

found a ring of workers of *Tetramorium simillimum* completely encircling it, and protecting it by discharging fluid at ants of other species, while workers of their own species were passing between them and fetching the food. *Pheidole* workers and *Paratrechina fijiensis* on their approach would receive a volley, and at once turn and make off at full speed, stopping to cleanse their antennæ, legs, and face of the obnoxious fluid, which was presumably formic acid, although I could not detect any odour. Upon one occasion, in the Fautaua Valley, this circle formed by the same species was broken by the workers of *Anoplolepis longipes*. The *Tetramorium* workers had not completed the ring, other members



Workers of *Tetramorium simillimum* defending food.

were hurrying up to take their places, when a determined attack was made upon them by the larger species. One of the attackers hesitated and then turned back from the firing-line, going through rapid motions of cleaning the antennæ. Others, however, successfully avoided the fusilage and reached the gaps in the half-formed circle, whence they strode over the small ants, seized them from above in their strong mandibles, shook them as a terrier does a rat, and tossed the limp bodies aside. Four or five of the *Anoplolepis* workers fell upon the unfortunate defenders in this fashion, the remainder of the latter escaped by running away, apparently realizing that they had failed to bring off their usual

manœuvre. They did not even wait to rescue their dying comrades, none of whom recovered sufficiently to crawl away, but were left strewed around the booty, which was speedily collected by the *Anoplolepis* workers. It was interesting in the foregoing episode to mark that the position taken by the *Tetramorium* workers when forming the ring did not vary. Each took her allotted place, and did not move from it even while the *Anoplolepis* workers were breaking through, although it appeared that if a defending worker had but slightly changed her attitude, so as to cover an approaching attacker, the latter would have been kept back until the ring was completely formed. There seemed no possibility that the workers were actually aiming at the oncomers, since they were arranged with their heads facing the centre of the circle, and they remained immovable with the exception of the antennæ. It is difficult to understand how they knew the exact moment at which to fire, unless they perceived by sound when the enemy came within range. I never saw one of their own workers hit by mistake.

Distribution. Tropical countries (including Mediterranean district), Galapagos Is., Fiji, Borneo.

13. *Tetramorium guineense* (F.).

Formica guineense, F., Ent. Syst. ii. p. 357 (1793) (Guinea); Mann, Bull. Mus. Comp. Zool. lxiii. p. 346 (1919) (Solomon Is.); id. *l. c.* lxiv. p. 459 (1921) (Fiji); Emery, Gen. Ins., Formic. fasc. 174, p. 278 (1921); Santschi, Ins. Samoa, pt. v. fasc. 1, p. 40 (1928); Wheeler, Proc. Calif. Acad. Sci. (4) ii. pp. 274 & 303 (Galapagos Is., Cocos Is.); id. Bull. Mus. Comp. Zool. lxiii. p. 91 (1919).

Marquesas Is.: Nuku-hiva, Taipi Valley, ♀ ♀ in rotten wood. Fatu-hiva, ♀ ♀ in valleys, Jan. 1925. Society Is.: Tahiti, ♀ ♀ in the sugar-cane fields near Papeete, l. iv. 25; ♀ ♀ on Coccids in the Valley Vaitepiha, 8. viii. 25. Raiatea, ♀ ♀ on a miniature coral islet 16 square yards, with a few yards of water separating it from the land except at low tide, at which times the workers could be seen crossing over, 6. vi. 25.

Distribution. Tropical countries, Hawaii, Fiji, Borneo, Cocos Is., Samoa.

14. *Tetramorium pacificum*, Mayr, Verh. zool.-bot. Ges. Wien, xx. pp. 952 & 976 (1870) (Tonga Tabu); Wheeler, Bull. Mus. Comp. Zool. lxiii. p. 91 (1919) (Borneo); Mann, Bull. Mus. Comp. Zool. lxiv. p. 459 *Ann. & Mag. N. Hist.* Ser. 10. Vol. ii. 35

(1921) (Fiji); Emery, Gen. Ins., Foricid. fasc. 174, p. 284 (1921).

Society Is. : Tahiti, Vallée de la Mission, 2 miles inland, a trail of workers on a rock, 28. iii. 25. On the borders of Lake Vaihira, 12 miles inland, at 1200 ft., ♀ ♀ came to tinned fish and a dead rat, 20. vii. 25.

Distribution. Friendly Is., Papua, Ceylon, Borneo.

15. *Tetramorium tonganum*, Mayr, Verh. zool.-bot. Ges. Wien, xx. pp. 972-6 (1870); Mann, Bull. Mus. Comp. Zool. lxiii. p. 348 (1919) (Solomon Is.); id. l. c. lxiv. p. 459 (1921) (Fiji); Emery, Gen. Ins. fasc. 174, p. 284 (1921).

Marquesas Is. : Nuku-hiva, ♀ ♀ among dead leaves, Jan. 1925.

Distribution. Tonga Is., Solomon Is., Sumatra, Fiji.

DOLICHODERINÆ.

16. *Tapinoma melanocephalum* (F.).

Formica melanocephalum, F., Ent. Syst. ii. p. 353 (1793) (Cayenne); Emery, Gen. Ins., Formic. fasc. 137, p. 41 (1912); Wheeler, Bull. Mus. Comp. Zool. lxiii. p. 100 (1919) (Borneo); id. Proc. Calif. Acad. Sci. (4) ii. p. 275 (1919) (Galapagos Is.); Mann, l. c. lxiv. p. 473 (1921) (Fiji).

Society Is. : Tahiti, abundant; ♀ ♀ from nest in soil in the sugar-cane fields near Papeete, 1. iv. 25. At Patutun, ♀ ♀ on Coccids and on the extra-floral nectaries of *Hibiscus tiliaceus* (see below), 24. iii. 25. Raiatea, village of Uturoa, ♀ ♀ hunting over my bed and mosquito-curtains for squashed mosquitoes; abundant in houses, where they nested between the boards of the floor; ♂ ♀ ♀ from nest between boards on the verandah, 19. vi. 24. Workers were always to be found upon the extra-floral nectaries of *Hibiscus tiliaceus*, which also attracted larger species. These curious nectaries develop on the main nerves of a mature leaf at its base in the form of deep longitudinal furrows lined with glandular hairs. They have been described by Delpino (Mem. Acad. Sci. Inst. Bolog. (4) vii. p. 232 (1886-87)).

Distribution. Tropical countries, carried on ships. Hawaii, Fiji, Galapagos Is., Borneo.

17. *Technomyrmex albipes* (Sm.).

Formica (*Tapinoma*) *albipes*, Smith, Journ. Proc. Linn. Soc. vi. p. 38 (1861); Emery, Gen. Ins., Formic. fasc. 137, p. 43 (1912).

Society Is.: Tahiti, ♀♀ forming a broad trail on a tree-trunk, Vallée de la Mission, 2 miles inland, 28. iii. 25. Coast-hills behind Papeete, ♀♀ tending Coccids and in galleries inside a log of wood, 16. iv. 25. Vaitepiha Valley, ♀♀ tending Coccids, 7. viii. 25.

Distribution. A widely distributed Oriental tropical species. India, Malaya, Australia, New Guinea, Solomon Is.

18. *Technomyrmex albipes*, var. *vitiensis*, Mann, Bull. Mus. Comp. Zool. lxiv. p. 473 (1921); Santschi, Ins. Samoa, pt. v. fasc. 1, p. 52 (1928).

Marquesas Is.: Nuku-hiva, Hiva-oa, Fatu-hiva, ♀♀ in cultivated valleys, Jan. 1925. Society Is.: Tahiti. On the coast at Tautira, ♀♀ tending Coccids; a small colony in Valley Vaitepiha, ♂♀ inside discarded silken burrows of a lepidopterous larva, on the under surface of a dried coconut-palm leaf, 7. viii. 25. Raiatea, ♀♀ tending Coccids on the coast, May 1925.

Distribution. Fiji, Samoa.

CAMPONOTINÆ.

19. *Anoplolepis longipes* (Jerd.).

Formica longipes, Jerdon, Madras Journ. Lit. & Sci. xvii. p. 112 (1861) (India).

Plagiolepis longipes, Wheeler, Bull. Mus. Comp. Zool. lxiii. p. 101 (1919) (Borneo); Mann, Bull. Mus. Comp. Zool. lxiii. p. 366 (1919) (Solomon Islands); id. l. c. lxiv. p. 474 (1921) (Fiji); Emery, Gen. Ins. fasc. 183, p. 17 (1925); Santschi, Ins. Samoa, pt. v. fasc. 1, p. 53 (1928).

Abundant upon all the islands visited. Marquesas Is.: Hiva-oa, Tahuata, ♀♀ tending Coccids; Fatu-hiva, ♀♀ in galleries under bark and tending Aleurodid larvæ in the valleys, Jan. 1925. Tuamotu Arch.: Faka-rava, ♀♀ on a trail on the beach, also upon dead molluscs, 11. ii. 25. Society Is.: Tahiti, ♀♀ tending Coccids high up the Vallée de la Mission, 28. iii. 25. Nests under stones in the sugar-cane fields near Papeete, 4 ♂♂ and workers, 13. iv. 25; ♀♀ among bracken at 3500 ft., 17. iv. 25. At Patutua ♂ at

light, 25. vii. 25. Raiatea, N.E., ♀ ♀ from a nest among roots of coconut-palm on the shore, 27, v. 25, ♀ ♀ on the beach, 3. vi. 25. Valley Vairumai, ♀ ♀ tending Coccids, 4. vi. 25.

Distribution. Tropical Asia, Borneo, Solomon Is., Fiji.

20. *Plagiolepis augusti*, Emery, Ann. Soc. Ent. Belg. lxi. p. 317 (1921) (Fiji).

Plagiolepis foreli, Mann, Bull. Mus. Comp. Zool. lxiv. p. 473 (1921) (Fiji); Emery, Gen. Ins. fasc. 183, p. 20 (1925).

Society Is.: Tahiti, Vallée de Ste. Amélie, 4 ♀ ♀ in galleries behind bark, 15. iv. 25; ♀ ♀ from a nest in a rotten log, 16. iv. 25.

Distribution. Fiji.

21. *Plagiolepis mactavishi*, Wheeler, Bull. Amer. Mus. Nat. Hist. xxiv. p. 166 (1909); id. Nat. Hist. Juan Fernandez and Easter Island, iii. p. 318 (1923) (Easter Island).

Marquesas Is.: Tahuata, 4 ♂ ♂, 4 ♀ ♀, Jan. 1925.

Distribution. Formosa, Hawaii, Easter Is.

22. *Paratrechina longicornis* (Latr.).

Formica longicornis, Latreille, Hist. Nat. Fourmis. p. 113 (1802) (Senegal).

Prenolepis (Nylanderia) longicornis, Wheeler, Bull. Mus. Comp. Zool. lxiii. p. 103 (1919) (Borneo); Mann, Bull. Mus. Comp. Zool. lxiii. p. 306 (1919) (Solomon Is.); Wheeler, Proc. Calif. Acad. Sci. (4) ii. p. 276 (1919); Emery, Gen. Ins., Formic. fasc. 183, pp. 210-17 (1925); Santschi, Ins. Samoa, pt. v. fasc. 1, p. 53 (1928).

Marquesas Is.: Tahuata, ♀ ♀, Jan. 1925. Society Is.: Tahiti, Vallée de Ste. Amélie, 12 ♀ ♀ with pupæ under a board near a ruined hut 2 miles inland, 15. iv. 25. Bora Bora, 3 ♀ ♀ in soil runways under a board on the coast.

Distribution. Tropicopolitan. Hawaii (abundant), Fiji (abundant), Borneo, Samoa, Galapagos Is.

23. *Paratrechina (Nylanderia) bourbonica*, subsp. *bengalensis*, Forel, Journ. Bombay N. H. Soc. viii. pp. 406-7 (1894); Mann, Bull. Mus. Comp. Zool. lxiv. p. 476 (1921)

(Fiji); Emery, Gen. Ins. fasc. 183, p. 219 (1925); Santschi, Ins. Samoa, pt. v. fasc. 1, p. 55 (1928).

Marquesas Is.: Nuku-hiva. Nest inside the spongy roots of the Giant Hartstongue (*Asplenium nidus*). Tahuata and Fatu-hiva, fairly numerous near the coast. Tuamotu Arch.: Faka-rava, ♂ ♀ ♀ ♀ in an earthen shelter built on the under surface of leaves, ♀ ♀ on blossoms, Feb. 1925. Society Is.: Tahiti, ♀ ♀ about 2 miles inland on the coast-hills behind Papeete, 16. iv. 25. Valley Vaitapiha, ♀ ♀ tending Coccids, 14. viii. 25. Raiatea, nests numerous on the shore under boards and stones; workers inside a drifting trunk saturated with sea-water which was embedded in the mud on the lagoon (these ants appeared quite indifferent to salt-water), 27. v. 25; 4 ♂ ♀ at light on the coast, 3. vi. 25. Bora Bora, ♀ ♀ on a small plateau below Mt. Popoti, 14. vi. 25, ♀ ♀ on a reef-islet, Motu Monte, 16. vi. 25.

24. (?) *Paratrechina vitiensis*, Mann.

Prenolepis (Nylanderia) vitiensis, Mann, Bull. Mus. Comp. Zool. lxiv. p. 474, fig. 28 (1921) (Fiji).

The specimens can in all probability be assigned to this species, but in the absence of the male it cannot be satisfactorily determined.

Society Is.: Tahiti, coast-hills behind Papeete, ♀ ♀ among bracken, 3000 ft., nest in log of rotten wood; Valley Vaitapiha, 3 ♂ ♀, and ♀ ♀ nest under stones; Raiatea, at the head of a gulley at about 2000 ft., ♀ ♀ ♀ nest in rotten wood.

Distribution. Fiji.

25. *Lasius claviger*, Roger.

Formica claviger, Roger, Berl. Ent. Zeitschr. vi. p. 241, pl. i. fig. 13 (1862); Wheeler, Journ. N.Y. Ent. Soc. xix. p. 262 (1911) (Tahiti).

Tahiti: Papeete, nesting under stones in the town.
(Not among present collection.)

Distribution. U.S.A., especially the Eastern States.

LXVII.—*New Species of Philippine Noctuidæ.*

By A. E. WILEMAN, F.E.S., and R. J. WEST.

[Specimens collected by A. E. Wileman, the types being in the Wileman Collection. Ridgway has been used as the standard for colours. Patagium = collar-tippet; tegula = wing-base cover.]

EUTELINÆ (Phlogophorinæ).*Phlogophora triangulatrix*, sp. n.

Male.—Palpus: first segment and base of second segment warm blackish brown, remainder of second and the whole of third segments light buff. Antenna: fasciculate on basal half, gradually diminishing in length to short paired setæ on distal half. Head: frons light buff, vertex pale vinaceous drab, a pointed tuft between the bases of antennæ projecting forward. Thorax with dorsal crest of pale vinaceous drab tipped with fawn-colour, patagium and tegula pale vinaceous drab, and a few warm blackish-brown scales. Abdomen light buff irrorated with fawn-colour, a warm blackish-brown tuft at base, venter light buff tinged with vinaceous drab, and some blackish-brown scales, anal tuft verona-brown. Pectus light buff. Legs: fore leg, coxa light vinaceous drab, femur and tibia light buff speckled with fuscous, other legs light buff speckled with fuscous, all tarsal segments fuscous, joints light buff. *Fore wing*, from base to ante-medial fascia pallid vinaceous drab, irrorated with blackish brown, an oblique, slightly excurved, fascia of two fine fawn-coloured lines, from orbicular to inner margin sub-basally, bordered proximally by white; orbicular a small cartridge-buff spot outlined with fawn-colour, reniform a pear-shaped fawn-coloured patch outlined with cartridge-buff; a blackish-brown line from costa medially, oblique to reniform, then oblique and slightly incurved to inner margin, the reniform covering the line where it angles; area from medial to subterminal fasciæ, pallid vinaceous drab tinged with fawn-colour; postmedial a fine cartridge-buff, wavy line, oblique to vein 6, outwardly angled, then straight to vein 3, then incurved to inner margin; a white spot below vein 2 touching the distal edge of postmedial; subterminally on costa a triangular fawn-coloured patch outlined with white, from the apex of which the subterminal fascia continues as a zigzag blackish brown edged with cartridge-buff to vein 3, then wavy, faintly marked with cartridge-buff to inner margin; a pallid vinaceous drab patch on termen from apex to vein 3. *Hind wing* cartridge-buff tinged with vinaceous drab, some

blackish-brown scales on veins 2, 3, and 4, and at tornus. *Underside*: fore wing cartridge-buff tinged with vinaceous drab, blackish-brown spot on discocellulars, a fuscous post-medial fascia, a white spot near apex, below this two fuscous spots; hind wing cartridge-buff tinged with vinaceous drab on upper half, irrorated with blackish brown on lower half, a blackish-brown spot on discocellulars, blackish brown on subterminal and at tornus.

Expanse 26 mm. (tip to tip 24 mm.).

Female.—Similar to male, the antennæ differing in being minutely ciliated, with paired setæ.

Expanse 26 mm. (tip to tip 24 mm.).

Holotype (♂). Manila, prov. Rizal, Luzon I., Philippine Is. (plains), 20. iii. 1912.

Allotype (♀). Palali, subprov. Benguet, Luzon I., Philippine Is., 2000 ft., 1. vii. 1913.

Paratypes. Klondyke, subprov. Benguet, Luzon I., Philippine Is., 800 ft., 1 ♂, 18. iv. 1912; 1 ♀, 18. iii. 1912; 1 ♀, 14. iv. 1912.

Nearest ally, *P. affinis*, Hmps. (Formosa).

Phlogophora griseo-apicata, sp. n.

Female.—Palpus: first segment and basal half of second segment fuscous-black, distal half of second segment and all third segment cartridge-buff speckled with fuscous-black. Antenna: shaft fuscous, with paired setæ. Head: frons and vertex cartridge-buff with a few fuscous-black scales between the bases of antennæ. Thorax: patagium and tegula fuscous tinged with fuscous-black. Abdomen: cinnamon-drab with fuscous-black dorsally, venter cartridge-buff tinged with bister. Pectus cartridge-buff. Legs: cartridge-buff with fuscous above, tarsal segments fuscous, joints cartridge-buff. *Fore wing*: cinnamon-drab at base, sub-basal fascia wavy, bister; antemedial fascia a wide band of fuscous-black, proximal edge excurved, distal edge straight; area between antemedial and postmedial fasciæ cinnamon-drab, with a narrow fascia of bister medially, and a shade of bister on reniform; postmedial fascia consisting of a narrow fuscous-black line, bordered distally by a suffusion of bister, angled from costa to subcosta, excurved to vein 5, oblique to vein 4, outwardly angled, oblique to vein 2, straight to inner margin; subterminal fascia fuscous-black, commencing with a triangular patch with two pearl-grey points on costa, from apex of triangle the fascia is excurved to vein 6, laterally along vein for a short distance basally, oblique to vein 4 where it is sharply angled and zigzags to inner margin, bordered distally by a pearl-grey patch from apex to

vein 3; terminal line fuscous-black, fringe pearl-grey with fuscous spots. *Hind wing*: basal half white, distal half fuscous, a small white patch at tornus, fringe pearl-grey with a tinge of fuscous on edge. *Underside*: *fore wing* cartridge-buff tinged with bister, irrorated with bister below costa, bister postmedial and subterminal fasciæ, terminal line fuscous-black with interneural triangular spots (points basad), a tinge of pearl-grey near apex; *hind wing* cartridge-buff irrorated below costa and on distal half with bister, bister spot on discocellulars, postmedial fascia marked by being more thickly irrorated, terminal line fuscous-black with interneural spots (points basad).

Expanse 34 mm. (tip to tip 32 mm).

Holotype (♀). Klondyke, subprov. Benguet, Luzon I., Philippine Is., 800 ft., 9. iii. 1912.

Nearest ally, *P. suffundens*, Wlk. (Singapore, Borneo).

Chlumetia multilineata, sp. n.

Male.—Palpus: first segment and basal half of second segment warm blackish brown, distal half of second segment and the whole of third segment light buff mixed with some warm blackish brown. Antenna: pectinated on basal half, graduating to short paired setæ at extremity. Head: frons and vertex light buff. Thorax: patagium wood-brown suffused with warm blackish brown, tegula wood-brown with a tuft tinged with warm blackish brown centrally. Abdomen light buff tinged with fuscous, a warm blackish-brown patch at base, venter light buff lightly tinged with fuscous, anal tuft wood-brown tinged with fuscous. Pectus: light buff. Legs: fore leg, coxa Hay's russet, femur, tibia, and tarsus light buff with a mixture of Hay's russet and fuscous above, mid leg light buff, with fuscous and Hay's russet on tibia and tarsus, hind legs light buff. *Fore wing*: ground-colour cartridge-buff suffused with dull citrine, with two longitudinal streaks of Hay's russet, one in distal half of cell, the other below vein 2; sub-basal fascia fuscous, excurved to median fold; antemedial fascia consisting of two fuscous lines with the space between tinged with fuscous, excurved to median nervure, then incurved to inner margin; orbicular and reniform outlined with fuscous, between these passes a medial fascia, commencing at costa as two fuscous lines, which gradually converge and form one line from anal vein to inner margin; postmedially, a fuscous shade bordered distally by a band of cartridge-buff of the same width, in which is a narrow fuscous line; subterminal area Hay's russet suffused with fuscous, in which is a narrow, wavy,

light buff fascia, terminal line fuscous, fringe fuscous with a light buff line at base. *Hind wing*: fuscous, light buff subterminal fascia from vein 5 to inner margin near tornus, fringe fuscous with a light buff line at base. *Underside*: *fore* and *hind wings* Hay's russet suffused with fuscous, with three fuscous fasciæ medially, postmedially, and subterminally.

Expanse 28 mm. (tip to tip 27 mm.).

Female.—Similar to male, differing only in the antennæ having short-paired setæ for the whole length.

Expanse 28 mm. (tip to tip 27 mm.).

Holotype (♂). Montalban, prov. Rizal, Luzon I., Philippine Is., 25. iv. 1914.

Allotype (♀). Palali, subprov. Benguet, Luzon I., Philippine Is., 2000 ft., 27. xii. 1912.

Nearest ally, *C. alternans*, Moore (India).

Anuga cineracea, sp. n.

Male.—Palpus: cartridge-buff suffused with russet and blackish brown on first segment and basal half of second segment, distal half of second segment and the whole of the third segment cartridge-buff tinged with hazel below. Antenna: basal half pectinated, distal half with paired setæ. Head: frons with a smooth corneous plate and cartridge-buff above it, vertex cartridge-buff, with a tuft of cartridge-buff suffused with hazel projecting forward between the bases of antennæ, occiput warm blackish brown. Thorax: patagium cartridge-buff irrorated with hazel, with a velvety warm blackish-brown line through centre, tegula cartridge-buff tinged with hazel and a little fuscous posteriorly. Abdomen: cartridge-buff lightly irrorated with fuscous, tinged with hazel on side, venter cartridge-buff suffused with hazel and fuscous. Pectus: cartridge-buff. Legs: cartridge-buff, fuscous on tarsal segments. *Fore wing*: cartridge-buff suffused with vinaceous drab on lower half; antemedial fascia consisting of two fine, wavy, avellaneous lines with a little warm blackish brown on the distal one; orbicular a vinaceous-drab spot, reniform marked by a lunule of hazel and a broken outline of warm blackish brown; a faint ex-curved fascia of vinaceous drab medially; postmedial fascia crenulate, fuscous with cartridge dots at points on veins (points distad); subterminal fascia wavy, avellaneous; inter-neural fuscous spots on termen. *Hind wing*: cartridge-buff suffused with vinaceous drab on area between veins 2 to 6, and on inner margin, a short incurved light buff line near tornus. *Underside*: *fore wing* cartridge-buff suffused with fuscous; *hind wing* cartridge-buff irrorated with fuscous

below costa; medial, postmedial, and subterminal fasciæ fuscous; a fuscous spot on discocellulars.

Expanse 30 mm. (tip to tip 29 mm.).

Holotype (♂). Baguio, subprov. Benguet, Luzon I., Philippine Is., 5000 ft., 18-24. iii. 1912.

Nearest ally, *A. constricta*, Guen. (Singapore, Borneo).

Anigraea albibasis, sp. n.

Male.—Palpus fuscous. Antenna with short paired setæ. Head: frons fuscous, vertex avellaneous. Thorax: with a patch of warm blackish brown on metathorax, patagium avellaneous, tegula fuscous. Abdomen: light buff suffused with fuscous, fuscous-black in centre dorsally, avellaneous at base, venter light buff tinged with fuscous, streaked longitudinally with fuscous, anal tuft avellaneous tinged with fuscous. Pectus light buff. Legs: fore leg light buff with fuscous above, other legs light buff speckled with fuscous. *Fore wing*: fuscous at base, dividing into three streaks, one along and below costa, another along median nervure and veins 2, 3, and 4, the third along inner margin, cartridge-buff tinged with fuscous in the spaces between; a fuscous-black spot near apex, and a light buff patch at tornus. *Hind wing*: basal half cartridge-buff, distal half fuscous, fuscous-black at tornus. *Underside*: *fore wing* cartridge-buff tinged with fuscous; *hind wing* cartridge-buff irrorated with fuscous below costa, suffused with fuscous in upper half of subterminal area, a fuscous-black patch at tornus.

Expanse 24 mm. (tip to tip 23 mm.).

Holotype (♂). Klondyke, subprov. Benguet, Luzon I., Philippine Is., 800 ft., 8. iv. 1912.

Nearest ally, *A. rubida*, Wlk. (India, Singapore, Borneo).

Pæctes callopiroides, sp. n.

Male.—Palpus fuscous-black, with light buff beneath. Antenna with short paired setæ. Head: frons and vertex light buff mixed with Indian red. Thorax: patagium light buff mixed with Indian red, tegula burnt umber with a purple sheen. Abdomen: fuscous with a purple sheen, a crest at base, light buff on two anal segments dorsally, warm buff laterally, a lateral series of tufts, below each tuft a fuscous-black spot; venter light buff suffused with Indian red. Pectus warm buff. Legs: light buff suffused with Indian red, tarsal segments fuscous, light buff at joints. *Fore wing*: ground-colour burnt umber with a purple sheen, sub-basal fascia wavy, fuscous-black; antemedial fascia consisting of two fuscous-black lines, straight to subcosta,

excurved to anal vein, then straight to inner margin; orbicular a pearl-grey speck, reniform deep olive-buff with a fine line of burnt umber in centre, and two pearl-grey spots, one at each angle of lower edge; a fine fuscous-black line from costa medially, sharply curving to centre of proximal edge of reniform, continuing from centre of distal edge of reniform, sharply excurved, then slightly wavy to inner margin; postmedial fascia a double fuscous-black line with four pearl-grey specks between, oblique to vein 6, sharply excurved to and oblique to vein 2, then slightly excurved to inner margin; subterminally a burnt umber triangle with three pearl-grey specks at edge on costa, bordered by pearl-grey on the other two sides, which continues as a wide ragged fascia with three fuscous-black spots between veins 4 and 6. *Hind wing*: light buff suffused with fuscous, with some pearl-grey marks near torus, terminal line fuscous. *Underside*: *fore wing* light buff irrorated with Indian red below costa, tinged with fuscous centrally, light buff along inner margin, an irroration of pearl-grey and fuscous at apex; *hind wing* light buff irrorated with Indian red, a fuscous spot on discocellulars, and fuscous medial and post-medial fasciæ.

Expanse 26 mm. (tip to tip 25 mm.).

Holotype (♂). Klondyke, subprov. Benguet, Luzon I., Philippine Is., 800 ft., 11. iii. 1912.

Nearest ally, *P. subapicalis*, Wlk. (India).

STICTOPTERINÆ (Odontodinæ).

Odontodes griseifusa, sp. n.

Female.—Palpus: light buff speckled with bone-brown. Antenna with minute setæ. Head: frons with smooth corneous plate, light buff above, vertex bone-brown. Thorax: patagium and tegula bone-brown. Abdomen: bone-brown, venter light buff tinged with bone-brown, anal tuft bone-brown. Pectus light buff. Legs: light buff speckled with bone-brown, tarsal segments warm blackish brown, joints light buff. *Fore wing*: from base to medial fascia warm blackish brown, with a light mineral-grey streak on inner margin for two-thirds; sub-basal fascia wavy, light buff; antemedial fascia wavy, warm blackish brown edged with light buff; medial fascia light buff, oblique, incurved to subcosta, again incurved to median nervure, sharply excurved, oblique to anal vein, incurved to inner margin; area between medial and postmedial fasciæ warm buff suffused with dark livid brown, reniform outlined with blackish brown; postmedial fascia consisting of two blackish-brown

lines, straight to subcosta, along subcosta towards apex for a short distance, a zigzag excurve to vein 3, oblique to anal vein, outwardly angled and incurved to inner margin; subterminal area blackish brown with a fine light buff fascia, interneural blackish-brown spots edged with light buff. *Hind wing*: velvety warm blackish brown with a tinge of warm buff at base and on inner margin, fringe warm buff. *Underside*: *fore wing* warm buff suffused with fuscous, a warm buff patch in distal half of cell, and warm buff on inner margin; *hind wing* warm buff tinged with fuscous on basal two-thirds, suffused with fuscous on distal third, antemedial and postmedial fasciæ fuscous, fringe warm buff.

Expanse 50 mm. (tip to tip 47 mm.).

Holotype (♀). Haight's Place, subprov. Benguet, Luzon I., Philippine Is., 7000 ft., 27. vii. 1913.

Paratypes. Haight's Place, subprov. Benguet, Luzon I., Philippine Is., 7000 ft., 1 ♀, 26. vii. 1913, 1 ♀, 22. vii. 1913; Baguio, subprov. Benguet, Luzon I., Philippine Is., 5000 ft., 1 ♀, 30. v. 1913, 1 ♀, 3. xii. 1912.

Nearest ally, *O. metalmelæna*, Hmps. (New Guinea).

Stictopera hemiphæa, sp. n.

Female.—Palpus cartridge-buff tinged with mars-brown above. Antenna minutely ciliated, with paired setæ. Head: frons cartridge-buff on lower half, pale drab-grey mixed with mars-brown on upper half, vertex pale drab-grey suffused with mars-brown. Thorax: light buff, patagium pale drab-grey mixed with mars-brown, tegula mars-brown. Abdomen: light buff tinged with fuscous, venter warm buff with a patch of mars-brown at base, anal tuft warm buff. Pectus light buff. Legs: fore leg warm buff with mars-brown above, other legs warm buff lightly tinged with mars-brown, all tarsal segments mars-brown, warm buff at joints. *Fore wing*: basal half mars-brown, suffused with bone-brown near distal edge, on inner margin a fuscous-black patch at base followed by a mars-brown streak to near tornus, the distal edge of basal area, wavy, from costa medially to just below vein 2, where it is inwardly angled, then wavy to tornus; the distal half of wing pale drab-grey with a large patch of dark olive-buff tinged with mars-brown at end of cell and beyond; orbicular faintly marked, reniform outlined with fuscous-black, postmedial fascia crenulate (points distad), pale drab-grey faintly edged with fuscous-black, excurved to vein 3, oblique to anal vein; subterminal fascia a narrow, wavy, pale drab-grey line, with a bone-brown patch at costa, followed by a suffusion of mars-brown proximally, faintly edged with fuscous distally, interneural bone-brown spots on

termen, termen crenulate. *Hind wing*: semihyaline with a wide border of fuscous, fuscous on veins. *Underside*: *fore wing* warm buff at base, along costa, and inner margin, the rest suffused with fuscous; medial and postmedial fasciæ fuscous, three fuscous points on costa near apex; *hind wing* semihyaline at base bordered by fuscous, postmedial and subterminal fasciæ fuscous, an oblique fuscous mark from costa medially to discocellulars, fuscous lunule on discocellulars.

Expanse 42 mm. (tip to tip 41 mm.).

Holotype (♀). Haight's Place, Pauai, subprov. Benguet, Luzon I., Philippine Is., 7000 ft., 12. i. 1912.

Nearest ally, *S. signifera*, Wlk. (type Borneo).

Stictoptera albonotata, sp. n.

Male.—Palpus light buff with chocolate above. Antenna ciliated, with paired setæ, cilia very short. Head: frons light buff with a band of bone-brown through centre, vertex light buff tinged with chocolate. Thorax: patagium pinkish buff and bone-brown in alternate transverse bands, tegula pinkish buff and bone-brown in alternate longitudinal stripes. Abdomen fuscous with a dorsal crest tinged with cinnamon-brown, venter light buff tinged with fuscous, anal tuft cinnamon-brown. Pectus light buff. Legs: light buff speckled with livid brown, warm blackish brown on tarsal segments. *Fore wing*: natal brown, a blackish-brown line in basal half of cell, straight from base to antemedial, where it curves upward, then angled and joining orbicular; area below cell suffused with warm blackish brown, an elongate white spot below cell antemedially; orbicular outlined with blackish brown, filled with light buff, reniform outlined with light buff, filled with natal brown, a short blackish-brown bar connecting orbicular and reniform; claviform long, outlined with blackish brown; area beyond cell above vein 4 streaked longitudinally with light buff and warm blackish brown, below vein 4 warm blackish brown, not streaked; a bone-brown line from inner margin at base to lower angle of cell, where it is broken into several lines, one each along veins 2 and 3, and a double line, at right angles to the others, converging to one line at anal vein to inner margin. *Hind wing*: light buff tinged with bone-brown basally, suffused in subterminal area. *Underside*: *fore wing* light buff suffused with bone-brown, dark livid brown along costa; *hind wing* light buff with a band of fuscous subterminally, postmedial fascia and lunule on discocellulars fuscous.

Expanse 39 mm. (tip to tip 38 mm.).

Holotype (♂). Haight's Place, Pauai, subprov. Benguet, Luzon I., Philippine Is., 7000 ft., 1. vii. 1912.
Nearest ally, *S. timesia*, Swinh. (Singapore).

Stictoptera suffusa, sp. n.

Male.—Palpus blackish brown. Antenna fasciculate. Head: frons with smooth corneous plate and pale drab-grey mixed with blackish brown above, vertex pale drab-grey mixed with blackish brown. Thorax: patagium pale drab-grey mixed with blackish brown, a band of chestnut-brown through centre, and a tinge of chestnut-brown posteriorly, tegula cinnamon-buff tinged with chestnut-brown, with a blackish-brown, longitudinal stripe along upper edge. Abdomen: cinnamon-buff suffused with blackish brown, blackish brown dorsally, venter cinnamon-buff with a chestnut-brown patch near base, anal tuft cinnamon-buff. Pectus cinnamon-buff. Legs: chestnut-brown, blackish brown on coxæ of fore and mid legs. *Fore wing* cinnamon-buff tinged with chestnut-brown to antemedial, antemedial to postmedial fasciæ suffused with chestnut-brown, blackish brown on costa basally, medially, and postmedially; a wide suffusion of blackish brown and chestnut-brown along inner margin for three-quarters, reniform indicated by a small chestnut-brown spot; postmedial fascia, two diffused, crenulate lines, the proximal one chestnut-brown, the distal one blackish brown, excurved to vein 3, oblique to inner margin; subterminal fascia, a chestnut-brown shade parallel to termen, bordered proximally with cinnamon-buff tinged with chestnut-brown, subterminal area suffused with blackish brown, interneural blackish-brown spots on termen, and light buff points on veins at termen. *Hind wing*: semihyaline bordered with fuscous, fuscous on veins. *Underside*: *fore wing* light buff suffused with fuscous, postmedial fascia fuscous; *hind wing* semihyaline, light buff on costa basally, postmedial fascia fuscous, area beyond light buff suffused with fuscous, subterminal fascia faintly marked, fuscous on veins and discocellulars.

Expanse 50 mm. (tip to tip 48 mm.).

Holotype (♂). Haight's Place, Pauai, subprov. Benguet, Luzon I., Philippine Is., 7000 ft., 28. vii. 1913.

Nearest ally, *S. microthyris*, Hmps. (New Guinea).

Lophoptera lucida, sp. n.

Male.—Palpus light buff with some fuscous outwardly. Antenna: ciliated, with paired setæ, cilia very short. Head: frons fuscous, light buff with a fuscous tuft projecting forward between the bases of antennæ. Thorax: patagium fuscous with a chestnut-brown line through centre, tegula

fuscous. Abdomen: pale drab-grey suffused with fuscous, fuscous-black tuft dorsally, venter pale drab-grey. Pectus pale drab-grey. Legs: pale drab-grey with fuscous above, tarsal segments fuscous, pale drab-grey at joints. *Fore wing*: pale drab-grey, lightly tinged with fuscous, fuscous-black patch on costa at base, antemedially, a wide band of fuscous-black increasing in width toward inner margin; reniform outlined with fuscous-black, filled with fuscous; postmedial fascia pale drab-grey edged with fuscous-black, excurved and wavy to vein 3, incurved to inner margin; area from postmedial to termen suffused with fuscous, subterminal fascia pale drab-grey edged with fuscous-black distally, broken, wavy, commencing with a fuscous-black incurve at costa; terminal line pale drab-grey edged with fuscous-black distally, broken, two fuscous-black dashes near apex, termen fuscous-black, fringe pale drab-grey. *Hind wing*: semihyaline with a wide border of fuscous-black, fuscous-black on veins, fringe pale drab-grey. *Underside*: *fore wing* pale drab-grey, basal area fuscous, antemedial fascia fuscous, fuscous lunule on discocellulars, subterminal area fuscous; *hind wing* semihyaline, subterminal border of fuscous, a short fuscous dash from costa to discocellulars, fringe pale drab-grey.

Expanse 23 mm. (tip to tip 22 mm.).

Holotype (♂). Klondyke, subprov. Benguet, Luzon I., Philippine Is., 800 ft., 10. iii. 1912.

Nearest ally, *L. xista*, Swinh. (Ceylon, Singapore, Borneo).

Nigramma melanosticta, sp. n.

Male.—Palpus light buff mixed with warm blackish brown. Antenna minutely ciliated, with paired setæ. Head: frons and vertex light buff mixed with warm blackish brown, occiput light buff. Thorax: patagium and tegula light buff mixed with warm blackish brown. Abdomen: light buff suffused with fuscous, venter light buff irrorated with fuscous, anal tuft warm buff. Pectus light buff. Legs light buff tinged with warm blackish brown above, tarsal segments warm blackish brown, light buff at joints. *Fore wing*: light buff suffused with fuscous, a blackish-brown patch below cell antemedially, two blackish-brown spots near apex, and a few scattered blackish-brown specks. *Hind wing*: semihyaline bordered with fuscous, fuscous on veins. *Underside*: *fore wing* light buff at base, remainder fuscous; *hind wing* semihyaline bordered with fuscous, fuscous on veins.

Expanse 23 mm. (tip to tip 27 mm.).

Holotype (♂). Manila, prov. Rizal, Luzon I., Philippine Is. (plains), v. 1912.

Nearest ally, *N. lapidaria*, Wlk. (India).

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

April 4th, 1928.—Prof. J. W. Gregory, D.Sc., F.R.S.,
President, in the Chair.

The following communications were read:—

1. 'A Note on the Pleistocene History of Western Buchivacoa (Venezuela).' By John Parkinson, M.A., Sc.D., F.G.S.

The area consists of alternating estuarine or freshwater false-bedded sandstones, and sandy clays, folded along east-north-easterly axes in many places. Burdigalian and Aquitanian fossils occur in the eroded centres of the folds. There is an unconformity between the Miocene and the overlying strata, which appear to be of Lower or Middle Pliocene age.

The Tertiary deposits are covered by Pleistocene pebble-beds. The latter are probably an old sea-beach. Subsequent elevation during a pluvial period allowed of a 'creep' of the pebbles northwards. Redeposition in successive stages was effected by eastward-flowing rivers of the Indus type.

Since Pliocene times, an elevation of about 1000 feet has taken place along the southern edge of the district.

2. '*Gyrinodon quassus*, a New Genus and Species of Toxodont from Western Buchivacoa (Venezuela).' By A. Tindell Hopwood, M.Sc., F.L.S., F.G.S.; with a Note on the Reptilian Remains by William Elgin Swinton, B.Sc., F.L.S., F.G.S.

Diagnosis.—Toxodontidæ of medium size. Frontal region passing gently into the anterior portion of the temporal fossa. Postorbital processes greatly reduced. Neither the superior margin of the orbit nor the roof of the nasal chamber is inflated. Upper lateral incisor curved in an arc of 180° or more. First and second upper molars with a slight metaloph; third molar with long concave ectoloph, but no metaloph. Mandibular symphysis not extending backwards to the second lower molar. Third lower molar without a second, posterior, fold in the enamel of the lingual surface.

Remarks.—*Gyrinodon* differs from *Toxodon* in its more primitive dentition, and in the characters of the skull-cap. It differs from *Alitoxodon* in the characters of the mandibular symphysis.

This is the northernmost locality for Toxodonts hitherto recorded in South America. It serves to corroborate the records for Tarija and Nicaragua. Apparently the Toxodonts followed a northward dispersal, reaching the north of South America, and passing beyond it to southern North America.

The reptilian remains indicate the presence of Crocodiles and giant Tortoises.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 12. DECEMBER 1928.

LXVIII.—*New Oriental Curculionidæ.*

By GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.

THE types of the following new species will all be deposited in the British Museum.

Subfamily OTIORRHYNCHINÆ.

Cyphicerus humeralis, sp. n.

♂ ♀. Derm black, with dense dark brown scaling, except the following parts which are green: the greater part of the head and rostrum, the sides of the prothorax (more or less enclosing a variable dark patch) and a narrow median stripe which is usually reduced to a small elongate spot in the middle of the base, the scutellum, and numerous variable and irregular spots on the elytra, which are more scanty on the disk, but dense and more or less confluent at the sides and on the apical declivity.

Head with the eyes almost flattened; the forehead plane, finely striolate (partly hidden by scaling), its width much greater than the length of an eye (3:2). *Rostrum* as long as (♂) or a little shorter than (♀) its basal width; the posterior margin of the epistome obtusely carinate; the dorsal area almost plane, the anterior transverse ridge not

very distinct, the median carina prominent, the dorso-lateral ones parallel behind. *Antennæ* black or piceous, fairly densely clothed with pale green scaling; the scape stout, somewhat compressed, moderately curved, with the external apical angle slightly produced and the setæ recumbent; the funicle with joint 2 about 1.25 times the length of 1, joints 4-7 equal and 3 a little longer, each with a single whorl of setæ. *Prothorax* with the sides gently rounded, of equal width at base and apex, broadest about the middle; the base subtruncate, the dorsal anterior margin evidently sinuate, the postocular lobes broadly rounded and with minute vibrissæ; the dorsum even and with large close punctures, the interspaces being finely and shallowly punctate, and with a very shallow rounded impression on each side behind the middle on the edge of the green lateral stripe. *Elytra* with the shoulders rounded but distinctly projecting laterally, the apices separately rounded; the striæ deeper towards the base, the punctures being partly hidden by the scaling, striæ 5 and 6 markedly divergent basally, the intervals each with a single row of short pale recumbent setæ.

Length 5.2-7.2 mm., *breadth* 2.2-3.0 mm.

INDIA: Nilgiri Hills, 2 ♂♂, 2 ♀♀, 1894 (*Sir G. F. Hampson*); Nilambur, Madras, 5 ♀♀, vi.-vii. 1925 (*S. N. Chatterjee*).

From Nilambur the species was reported as defoliating teak-trees in plantations.

From nearly all the previously described species of *Cyphicerus* the present one can be distinguished by the lateral projection of the shoulders of the elytra and by the strong divergence of striæ 5 and 6 at the base; the latter character occurs, however, in another Indian species, "*Corigetus*" *emarginatus*, Fst., 1897, but this species differs also from *humeralis* in having two green stripes on each side of the prothorax, the dorsum of the elytra bears alternate light and dark stripes, the scape of the antennæ is subcylindrical, etc.

Genus *CYPHICERINUS*, nov.

This genus is proposed for certain species hitherto included in *Cyphicerus*, but which differ from it in the following combination of characters:—

Cyphicerinus.—Mentum with a transverse row of four long erect setæ; at the apex of the rostrum the carinate margin of the epistome is not lower than the adjoining inner margin of the scrobe. The funicle of the antennæ is clothed marginally with setæ and not with true scales. The general only with

sculpture is coarser, and the scaling is thinner and more patchy.

Cyphicerus.—Mentum with only two setæ; the inner margin of the scrobe distinctly higher than the margin of the epistome. The funicle of the antennæ is at least partly clothed with true scales. The general surface is smooth and densely squamose.

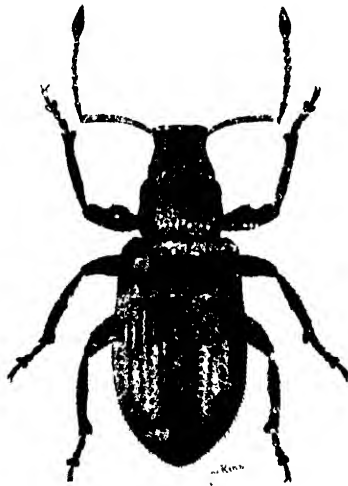
Genotype, *Mylocerus hirsutus*, Desbr., 1891.

Other species referable to this genus are *Cyphicerus nepalensis*, Fst., 1890, and *C. venalis*, Fst., 1895.

Cyphicerinus tectonæ, sp. n. (Fig. 1.)

♂ ♀. Derm rather shiny black or piceous, thinly and unevenly clothed with grey or brownish scaling, and usually with an irregular variable lighter transverse band behind

Fig. 1.



Cyphicerinus tectonæ, sp. n.

the middle of the elytra, which is more or less interrupted on intervals 1, 2, and 3, and is usually broader and more distinct in ♀.

Head with shallow scattered punctures that are hidden by scaling; the frons flattened, its width somewhat greater than the length of an eye, and with a deep elongate median

fovea. *Rostrum* rather shorter than its basal width (5 : 6), narrowed from the base to the antennæ, and sharply dilated at the apex; the median dorsal area flat or somewhat depressed, with three fine subparallel carinæ, of which the median one is not always quite straight, having beside it posteriorly a shallow stria that runs into the frontal fovea, this stria being sometimes on the right and sometimes on the left of the carina; the lateral areas with two sulci running from the upper angle of the scrobe to the eye and longitudinally striolate inferiorly. *Antennæ* castaneous; the scape subcylindrical, gently curved, gradually clavate, set with stout suberect curved setæ, and with the external apical angle projecting; the funicle with joint 2 a little longer than 1 (4 : 3), the remainder subequal and each with a single whorl of setæ. *Prothorax* moderately rounded at the sides, widest slightly behind the middle, of equal width at base and apex, feebly bisinuate at the base, with the apical margin shallowly sinuate, and the postocular lobes strong and with sparse fine vibrissæ; the dorsum with the coarse deep punctures partly obscured by the scaling and with a distinct shallow post-median impression on each side; the setæ much shorter than those on the elytra and suberect. *Elytra* separately rounded at the base, with the shoulders roundly rectangular, slightly widened behind the middle in ♂, more so in ♀; the striæ with large subquadrate punctures, which diminish rapidly behind, striæ 5 and 6 diverging at the base; the intervals about as wide as the striæ in the basal half, slightly convex, devoid of granules, and each with a row of stout erect setæ. *Legs* piceous, with sparse elongate scales and short pale subrecumbent setæ.

Length 4.2–5.0 mm., *breadth* 1.7–2.0 mm.

INDIA: Rahatgaon, Hoshangabad, Central Provinces, 5 ♂♂, 6 ♀♀, 17. vii. 1926 (*S. N. Chatterjee*).

The collector records that teak-trees (*Tectona grandis*) were being defoliated by adults of this species.

Nearly allied to *C. hirsutus*, Desbr., which is normally a much larger insect (length 5.0–7.5 mm.); the forehead is flatter and its width is much greater than the length of an eye (7 : 5); the rostrum has no median stria; the intervals of the elytra are irregularly set with fine sparse granules, the scales are more elongate, and the setæ relatively shorter and less erect.

Subfamily CLEONINÆ.

Pachycerus cynoglossi, sp. n.

♂ ♀. Derm black, slightly shiny; the elytra thinly clothed with small setiform grey scales, which are somewhat whiter here and there, producing a faintly mottled appearance; the prothorax with a narrow median line of dense setiform scales which is dilated in the middle into a diamond-shaped marking enclosing a shiny bare patch, and on each side two narrow lines of similar scales forming a distinct X.

Head very sparsely squamose, except for a dense ring round the eyes; the forehead confluent punctate and with a low rugose elevation above each eye. *Rostrum* very stout and angular, vertically flattened at the sides in the basal half, and only slightly dilated at the apex; the dorsum flattened and rugosely punctate, with two irregular broad furrows in the basal half, the dorsal margin being obtusely costate; the declivous apical area with two well-marked furrows delimiting the elongate triangular epistome; the lateral ante-ocular areas coarsely rugose. *Prothorax* nearly as long as broad, parallel-sided from the base to the middle, thence roundly narrowed, and with a tubular apical constriction; the postocular lobes broad; the dorsum gently convex longitudinally, highest in the middle, finely rugulose throughout, and set with numerous irregular low shiny granules, which are of very unequal sizes and more or less confluent; the shiny patch in the median diamond-shaped marking bearing a longitudinal furrow. *Elytra* oblong-ovate, much as in *P. varius*, Hbst., but less narrowed at the apex; the striæ distinct and regular, containing fairly close punctures that are a little wider than the striæ and gradually diminish towards the apex; the intervals broader than the striæ, flat, finely rugulose, and each with a row of very small granules throughout, these being more conspicuous near the base, and interval 3 with a slight granular basal elevation; the suture with a small elevation just behind the scutellum surrounded by a very shallow impression. *Legs* rugulose, with fairly dense grey scaling and bare black spots; the tibiæ with only a single spine at the inner apical angle; the hind tarsi with joint 2 about as long as 3. *Underside* with grey scaling and numerous irregular bare spots each of which contains a puncture.

Length 9.0–11.5 mm., *breadth* 3.2–4.0 mm.

INDIA : Pusa, Bihar, 2 ♂♂, 7 ♀♀, vii.-viii. 1922 (*Haq*).

The specimens were bred from larvæ boring in the roots of *Cynoglossum lanceolatum*.

This species belongs to the subgenus *Rhabdorrhynchus*, Mot., 1860, in which the lower surface is irregularly mottled. It closely resembles in general appearance *P. varius*, Hbst., which differs *inter alia* as follows: the ante-ocular area of the rostrum is smooth and rather sparsely punctate; the prothorax is distinctly broader than long and rather strongly rounded laterally; the tibiæ have two sharp spines at the inner apical angle, and joint 2 of the hind tarsi is distinctly longer than 3.

Subfamily HYLOBIINÆ.

Dyscerus kalshoveni, sp. n.

♂ ♀. Colour red-brown, the elytra rather paler, with a quadrate piceous patch slightly in front of the middle covering striæ 1 and 2 for a length of two punctures, a broad indefinite transverse piceous band (with its anterior margin sinuate) at about the middle extending from stria 3 to the lateral margin, and bordering this band in front a rather narrower ill-defined curved band formed of dense whitish setiform scales, a narrower indefinite sinuous macular band of similar scales across the top of the declivity, and a small transverse patch of whitish scales behind the posterior calli, the remainder of the elytra being thinly clothed with fulvous setiform scales and a few grey ones here and there.

Head with sparse fulvous setæ, the vertex with fine confluent punctation; the frons coarsely striolate and with a deep median fovea, exceptionally broad, the width being greater than the length of an eye. *Rostrum* straight and usually held vertically downwards; in ♂, as long as the head and pronotum, rugosely punctate throughout, the punctures in the basal half longitudinally confluent, with a very deep sulcus just above the scrobe from the base to beyond the middle, and a much shallower one above that; in ♀, longer than head and pronotum (4:3) and with the punctures rather smaller and less rugose. *Antennæ* with the scape unusually short, its apex separated from the eye by nearly one-third of its length; the funicle with joint 1 about equal to 2+3, 3-6 equal and strongly transverse, 7 broader and closer to the club than usual. *Prothorax* as long as broad, parallel-sided in the basal third, then gradually narrowing to the apex without any constriction; the apical margin

gently arcuate and feebly sinuate in the middle, the postocular lobes strongly developed, and the base bisinuate; the dorsum distinctly convex longitudinally and highest in the middle, strongly convex transversely, closely set with large rounded granules that become flattened towards the apex, and with a variable abbreviated median carina and a shallow impression in the middle of the base; each granule with a single short recumbent fulvous seta, and a few more in the interstices. *Scutellum* semicircular, sloping forwards, and shallowly impressed in the middle. *Elytra* oblong-ovate, widest at the rather prominent shoulders, very gradually narrowing behind, jointly rounded at the apex, and with the posterior calli rounded off and not very conspicuous; the striæ distinct and with regular quadrate punctures that diminish rapidly behind, the septa in the disk being narrower than the intervals, which are slightly convex and irregularly set with sparse flattened granules, interval 3 being feebly costate and bearing an elongate granular elevation near the base; the humeral calli also set with close flattened granules. *Legs* finely rugulose; all the tibiæ with a sharp tooth at the inner apical angle.

Length 9.6–11.4 mm., breadth 3.9–4.5 mm.

JAVA: Mt. Preanger, 1 ♂, 2 ♀ ♀, vii. 1927 (L. G. E. Kalshoven).

Dyscerus naso, sp. n.

♀. Colour black, rather thinly clothed with fulvous setiform scales, which are somewhat denser towards the base of the elytra and form a very indefinite, strongly angulated fascia across the top of the declivity.

Very closely related to *D. kalshoveni*, sp. n., but differing from it *inter alia* in the following characters:—*Head* with the median fovea placed further forward, being virtually on the base of the rostrum. *Rostrum* rather smoother and more shiny. *Prothorax* subconical, widest at the base and gradually narrowing anteriorly, with the sides much less rounded and without any apical constriction; the dorsum with much smaller and more separated granules, which are replaced by punctures at the apex. *Scutellum* bare and very shiny. *Elytra* wider at the shoulders, which project laterally in an obtuse angle, more distinctly arcuate at the base, separately rounded at the apex, and with the posterior calli very prominent and angular; the dorsum more rugosely sculptured, with the punctures much larger and fewer, but

becoming almost obliterated on the declivity, and with the septa about as broad as the intervals.

JAVA: Tjibodas, 1 ♀, v. 1916 (*H. C. Robinson*).

The only described *Dyscerus* that is nearly related to these two species is "*Hylobius*" *rectirostris*, Roelofs, from Japan, and together they form a well-marked group characterized by the very broad frons, the long straight rostrum, the short antennal scape, the granulate pronotum, and by the presence of a sharp tooth at the inner apical angle of the tibiae.

D. rectirostris differs from the other two species in having the prothorax slightly transverse, strongly rounded at the sides, shallowly constricted at the apex, much more strongly convex longitudinally, and without any median carina; the scutellum is strongly convex and elevated; the elytra are proportionately much shorter and broader, subparallel-sided from the shoulders to beyond the middle, with the shoulders not projecting laterally and the posterior calli sharply angulate; and the tooth at the inner apical angle of the tibiae is small and indistinct on the anterior pairs and obsolete on the hind pair.

Subfamily ERIRRHININÆ.

Derelomus cervicalis, sp. n.

♂ ♀. Pale yellow or very pale testaceous-brown; the head and rostrum dark brown; the pronotum with a broad dark brown median stripe, which is broadest much beyond the middle and usually narrows in front and behind.

Head with dense subconfluent punctation, the forehead slightly flattened. *Rostrum* a little longer than the pronotum in ♂ and slightly longer still in ♀, with five fine low carinae, which are rather less distinct in ♀. *Antennae* inserted at about one-fourth from the apex in both sexes, pale testaceous; joint 1 of the funicle much longer than any of the others, about as long as 2-4, 3-7 transverse. *Prothorax* slightly broader than long, widest at the base and gradually narrowing anteriorly, deeply constricted near the apex, so that the apical angles project obtusely; the dorsum with fine rugulose confluent punctation throughout and with a shallow transverse impression close to the apex, the lateral margins sharply carinate. *Scutellum* densely pubescent. *Elytra* oblong-ovate, jointly sinuate at the base, broadly rounded behind, and sparsely clothed with fine recumbent short pale pubescence; the striae shallow and closely set, with small round punctures, stria 8 being rather deeper and

1-3 curving outwards at the base; the intervals broad, almost flat, smooth and impunctate, interval 9 being subcostate along the edge of stria 8, especially in ♀.

Length 2.0-2.6 mm., *breadth* 0.9-1.3 mm.

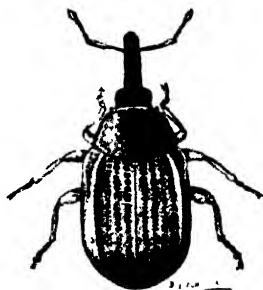
INDIA: Kanasar, 7050 ft., Chakrata Dist., United Provinces, 3 ♂♂, 2 ♀♀, v. 1922 (*S. N. Chatterjee*—type); Bodyar, 8300 ft., Chakrata Dist., 3 ♂♂, 1 ♀, v. 1922 (*Chatterjee*); Dehra Dun, U.P., 1 ♂, iii. 1921 (*Dr. M. Cameron*).

Derelomus bicarinatus, sp. n. (Fig. 2.)

♂ ♀. Very pale testaceous-brown, with the head and rostrum darker; the pronotum with a broad dark brown median stripe.

Head with fine rugulose punctation. *Rostrum* of ♂ about as long as the pronotum, cylindrical, moderately curved, and with five fine low carinæ, the antennæ being inserted at one-

Fig. 2.



Derelomus bicarinatus, sp. n.

fourth from the apex; of ♀, 1.5 times as long as the pronotum, with the carinæ equally distinct and the antennæ inserted at one-third from the apex. *Antennæ* pale testaceous; joint 1 of the funicle about as long as 2-4, 3-7 transverse in ♂, but 7 slightly longer than broad in ♀. *Prothorax* transverse (4:3), widest at the base and gradually narrowing anteriorly, slightly curved at the sides in ♂ and straight in ♀, very deeply constricted near the apex, with the apical angles very prominent and the basal margin broadly arcuate; the dorsum with fine rugulose confluent punctation throughout and with a shallow transverse impression near the apex, the lateral margins sharply carinate. *Elytra* of ♂ broadly ovate, widest behind the middle, shallowly sinuate behind

the shoulders, broadly rounded behind and jointly sinuate at the base; the striæ shallow and distinctly punctate, 1 and 2 curving outwards at the base, and 8 not deeper than the others; the intervals broad and flat, except 5, which is elevated into a high carina from near the base to the top of the declivity, all the intervals impunctate and sparsely clothed with very short recumbent pubescence; elytra of ♀ with the shoulders narrower and more sloping, and the carina on interval 5 much lower. *Legs* concolorous, the front tibiæ with a fringe of hairs on the lower edge in both sexes, but somewhat longer in ♂.

Length 2.6–3.0 mm., *breadth* 1.3–1.5 mm.

INDIA: Bodyar, 8300 ft., Chakrata Dist., United Provinces, 3 ♂♂, 2 ♀♀, v. 1922 (*S. N. Chatterjee*).

Genus DERELOMORPHUS, nov.

Closely related to *Derelomus*, Schönh., 1826, but differing from it in the following characters: all the femora bear a stout sharp tooth; the tibiæ are narrow and subcylindrical in the basal half, and nearly twice as broad in the apical half; the prothorax is not carinate on its lateral margins.

Genotype, *Derelomorphus eburneus*, sp. n.

Derelomorphus eburneus, sp. n.

♂ ♀. Uniform pale ivory-yellow, with the head, antennæ, suture, and tarsi darker; rostrum of ♂ blackish; club of antennæ and rostrum of ♀ red-brown.

Head with very fine close punctation, the frons somewhat flattened and with a small median fovea. *Rostrum* in ♂ a little shorter and in ♀ a little longer than the pronotum; in ♂ finely rugulose and with five narrow carinæ, the median one being the most distinct; in ♀ with dense, longitudinally confluent punctures, and the carinæ much less prominent, especially the lateral ones. *Antennæ* inserted at one-fourth from the apex in ♂ and at one-third in ♀; joint 1 of the funicle a little longer than 2+3, 3–7 transverse. *Prothorax* somewhat longer than broad, strongly rounded at the sides, broadest at more than one-third from the base, which is subtruncate, and with a tubular constriction at the apex; the dorsum with fine close (but not confluent) punctation throughout, the lateral margins not carinate. *Elytra* ovate, jointly and shallowly sinuate at the base, and sparsely clothed with fine short recumbent pale pubescence; the rows of

close punctures not or hardly striate and becoming rather indistinct behind and laterally; the intervals closely and irregularly punctate.

Length 2.0–2.2 mm., *breadth* 0.9–1.0 mm.

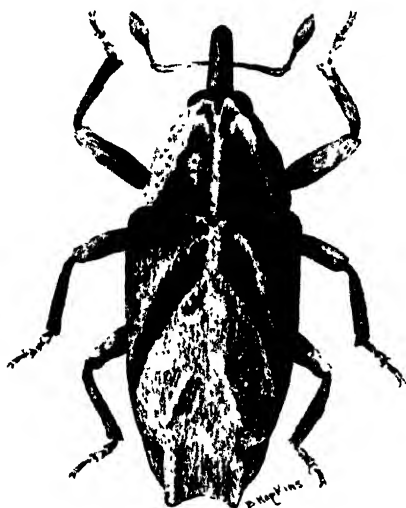
MALAY STATES: Sepang, 2 ♂♂, 7 ♀♀, bred from the male flowers of the coconut-palm, iv. 1928 (*G. H. Corbett*).

Subfamily *CRYPTORRHYNCHINÆ*.

Pachyonyx catechui, sp. n. (Fig. 3.)

♂ ♀. Derm chestnut-brown or piceous-brown, for the most part clothed with close short recumbent grey setæ, which are not sufficiently dense to hide the integument; the

Fig. 3.



Pachyonyx catechui, sp. n.

prothorax with the discal area behind the apical tufts apparently bare, except for a narrow median grey line, the sides grey outwards of a line running from the posterior apical tuft to the base opposite interval 5 of the elytra; the elytra with grey setæ except for an indefinite bare basal patch between striae 2 and 6, an elongate spear-like stripe running obliquely from close behind the scutellum to the apex of stria 7, and a short bare stripe at the base of interval 10, with some tufts of longer hairs on the disk.

Head with rather fine close unequal punctures and thin grey setæ; the frons flattened, as broad as the base of the rostrum, with a small median fovea and with denser setæ at the sides. *Rostrum* rather strongly curved, parallel-sided, almost bare and coarsely punctate in ♂ on the apical half and with irregular variable carinæ laterally, in the basal half less strongly punctate and rather densely setose; in ♀, much more finely punctate and sparsely setose. *Prothorax* about as long as its basal width, widest at the base, gradually narrowing to beyond the middle, and then rather strongly constricted; the base shallowly bisinuate and with a small excision in the middle; the dorsum with the usual four tufted tubercles towards the apex, and set with large shallow separated punctures that are strongly ocellated. *Scutellum* oblong and scarcely elevated. *Elytra* at the obliquely prominent and rounded shoulders one-third wider than the base of the prothorax, almost parallel-sided from there to the middle, and deeply constricted laterally before the apex, which is subtruncate, with a tufted prominence at the tip of interval 3; the striæ shallow, except at the base, with separated subquadrate punctures, which are much larger on the bare patches and much reduced near the apex, stria 10 very deeply impressed in about the basal fourth, stria 9 similarly impressed for a shorter distance and then with a brief interruption followed by a deep fovea; the intervals narrower than the striæ, with fine shallow punctures, the posterior calli very prominent and with a tuft of recumbent setæ; the apparently bare areas thinly clothed with short recumbent concolorous setæ; a denser stripe of grey setæ running from the base of interval 6 obliquely over the humeral callus as far as interval 10 just below the fovea in stria 9, and a similar stripe on interval 3 from near the posterior callus to the apex; the oblique bare stripe with its lateral edges at the base fringed with long suberect setæ, on intervals 3-5 on the external side and on interval 2 only on the inner side; interval 2 behind the middle with a similar line of long dense suberect setæ running obliquely backwards on to interval 3. *Legs* with fine rugose punctation and densely setose; the hind femur not reaching the apex of ventrite 2, and the hind tibiæ reaching only the apex of ventrite 4.

Length 5.75 mm., breadth 2.1 mm.

INDIA : Pusa, Bihar, 3 ♂♂, 1 ♀, vi. 1922 (Haq.).

The insects were bred from galls on twigs of *Acacia catechu*.

Readily distinguished from the two known Indian species, *P. quadridens*, Chev., 1880, and *P. sulcicollis*, Fst., 1895, by the oblique bare stripe on the elytra with its basal fringes of long setæ.

Subfamily ZYGOPINÆ.

Osphilia vitis, sp. n. (Figs. 4 & 5.)

♂ ♀. Derm red-brown, rather thinly clothed above with greyish-white, yellow, and dark brown setiform scales; the lower surface densely covered with greyish-white scales; the basal half of the rostrum densely clothed with yellowish scales in ♂, very sparsely so in ♀, the apical half honey-brown and bare. The pronotum with a median stripe of yellow scales which is twice as broad in the basal half as it is in the apical half, and a broad indefinite curved lateral

Fig. 4.



Front femur of *Osphilia vitis*, sp. n.

Fig. 5.



Front femur of *Osphilia odineæ*, Marshall.

stripe on each side formed of rather sparse yellow scales; the lateral stripes almost united with the median one along the apical margin and often connected with it at the middle by a few scattered scales. The elytra irregularly variegated with rather sparse, pale yellowish and dark brown scales; interval 1 with dense greyish-white scales, interrupted posteriorly by an elongate patch of dark brown scales, which is as long as the patch of white scales between it and the apex; the extreme lateral margins with a narrow line of whitish or

yellowish scales, and a small bare shining patch on the humeral callus.

Rostrum rather stout, strongly curved, being almost bent at the insertion of the antennæ, as long as the head and pronotum in ♀ and a little shorter in ♂, strongly narrowed from the base to the antennæ and then slightly widening to the apex; the basal half with coarse confluent punctation (finer in ♀) and a smooth median carina, the punctures and carina hidden by scaling in ♂ but not in ♀; the antennal insertion at the middle in ♂ and behind it in ♀. *Antennæ* testaceous, with the club darker; the scape very strongly clavate, and the upper surface of its club with rather dense elongate whitish scales; the funicle with the two basal joints of equal length, 3 as long as broad, and 4-7 transverse. *Prothorax* transverse, gently rounded at the sides, widest behind the middle; the dorsum distinctly convex longitudinally and highest not far from the base, with dense reticulate punctures throughout; the scales narrow and elongate (except some short broad whitish ones along the basal margin) and all lying transversely except those in the basal half of the median stripe, which are longitudinal. *Scutellum* with dense pubescent scales, with their apices directed forwards. *Elytra* with deep striæ containing deep distant punctures, which are separated by more than their own diameter; the intervals broader than the striæ and rather coarsely rugulose; interval 1 with simple setiform scales on the apical half, but those on the basal half are mostly ovate and pubescent; a few pubescent scales at the base of interval 2, but elsewhere all the scales setiform. *Legs* finely rugulose, pale testaceous-brown, fairly densely clothed with narrow elongate pale scales, the hind femora with a large dark subdenuded patch on the clavate part; the front femora much stouter than the others and with a very large triangular tooth, the tooth on the posterior pairs much smaller and spine-like. *Venter* of ♂ with a broad median depression on the basal ventrite that appears dark owing to the individual scales being greatly reduced in size; the anal ventrite with a quadrate bare median impression and a tuft of pale setæ on each side of it at the apex.

Length 3.6-3.9 mm, breadth 1.7-1.8 mm.

INDIA: Lachiwala Range, Dehra Dun, U.P., 6 ♂♂, 10 ♀♀, iv. 1921 (*Dr. C. F. C. Beeson*).

The specimens were bred from larvæ boring in the stems of *Vitis latifolia*.

Allied to *O. odinæ*, Mshl., 1921, which differs *inter alia* in having the prothorax almost parallel-sided in the basal half

and without any median pale stripe; the subapical sutural dark patch on the elytra is much shorter than the white area behind it; the tooth on the front femora is spiniform and not triangular, etc.

Osphilia gmelinæ, sp. n.

♀. Extremely similar superficially to *O. vitis*, sp. n., but slightly stouter in build. The pronotum with the median stripe of sparse yellowish scales (when complete) angularly dilated in the middle and thus forming an elongate diamond, the dark area around more sharply defined and roughly pentagonal; the elytra with patches of pale scales on the extreme lateral margin, but without a continuous pale line, the subapical dark sutural patch shorter than the pale area behind it, which is composed of yellowish (not white) spine-like scales.

Rostrum distinctly longer and less strongly curved than in *vitis*. *Antennæ* with the scape much less strongly and less abruptly clavate, and more sparsely squamose; the funicle with joint 2 appreciably longer than 1. *Elytra* with the intervals rather dull and finely aciculate (shiny in *vitis*) and much less coarsely rugulose, the scales being more numerous, and interval 2 with a row of whitish pubescent scales along its inner edge to beyond the middle. *Legs* with the tooth on the front femora broadly triangular, but with its anterior edge rather strongly curved, so that the point of the tooth projects forwards (in *vitis* the anterior edge is almost straight and the point does not project forwards); on the hind femora of *vitis* there is a small obtuse angulation a little beyond the spine-like tooth, which is lacking in *gmelinæ*.

Length 4·2–4·5 mm., *breadth* 2·1–2·2 mm.

INDIA: Sitapahar R., Chittagong Hill Tracts, 6 ♀ ♀, v.-viii. 1925 (*Dr. C. F. C. Beeson*).

The insects were bred from the wood of *Gmelina arborea*.

Phylaitis grewiaë, sp. n.

♂ ♀. Derm piceous or black; the head below the eyes with a patch of large buff-coloured scales; the rostrum with smaller buff scales at the sides near the base, and a triangular dorsal patch of narrower whitish scales between the eyes; the pronotum with a patch of large pale buff scales in the anterior lateral angles, within these a broad abbreviated stripe of paler narrower scales, and in the middle of the

front margin a short narrow median stripe of still narrower pale scales, along the basal margin a longitudinal patch of broad buff and white scales in the middle, with a patch of dark brown scales on each side of it, and outside of these a transverse patch of broad buff scales, the disk set with sparse small pale scales, leaving four indefinite darker patches, which bear brown scales; the scutellum with pubescent whitish scales; the elytra sparsely set with small pale buff and whitish scales and with a very indefinite broad oblique dark band (bearing brown scales) running from behind the shoulder to about the middle of the suture, and a still more indefinite small dark patch about the posterior callus, the punctures in the striæ each containing a large scale, which is brown on the dark areas and pale buff elsewhere; the lower surface densely clothed with large buff and whitish scales in varying proportions, but brown scales predominating laterally on the basal half of the metasternum.

Rostrum of ♂ stout, in large examples distinctly longer proportionately and more curved than that of ♀, but not in small specimens, closely and strongly punctate throughout, the punctures very rugose in the basal half, where there are five rather indefinite sinuous carinæ; the sculpture similar, but rather less coarse in ♀. *Antennæ* red-brown, inserted at about the middle of the rostrum in ♀ and well beyond the middle in ♂; joint 1 of the funicle slightly longer than 2 and both with white setiform scales, and joint 7 (attached to the club) strongly pedunculate, as long as the club, and with white setiform scales at the base. *Prothorax* broader than long (5:4), rounded at the sides anteriorly, widest much beyond the middle, abruptly constricted and subtubulate at the apex, the sides almost straight in the posterior half; the dorsum strongly convex longitudinally in large ♂ and highest at one-fourth from the base, less convex in ♀ and small ♂, with deep reticulate punctation throughout, each puncture containing a broad scale. *Elytra* subtriangular, transversely impressed at the base and with the basal margin elevated between striæ 1 and 5, the sutural area depressed in the basal half and not elevated behind, and the apical margin finely denticulate; the striæ deep, each puncture being covered by an oblong scale; the intervals broader than the striæ, rugulose, and each with a spaced row of small shiny granules, all of the same height, and without spines in ♂. *Legs* rugosely punctate and with mingled oblong white and buff scales; all the femora with a low carina on the outer and inner faces and with a small lobe beyond the tooth; the tibiæ sinuate dorsally on the apical

half; the front tarsi of ♂ fringed with long hairs. *Sternum* of large ♂ with the prosternal spines stout and strongly curved, the hollow between them broad, very deep and entirely bare; in small ♂, the spines shorter, the hollow between them much shallower and densely clothed with broad suberect scales. *Venter* of ♂ with a deep median depression on the basal ventrite; the anal ventrite not impressed and bare at the apex.

Length 5.7–6.0 mm., *breadth* 2.3–2.5 mm.

INDIA: Jhajra Range, Dehra Dun, United Provinces, 8 ♂♂, 3 ♀♀, 6. xi. 1924, bred from stems of *Grewia vestita* (C. F. C. Beeson).

Most nearly allied to *P. pterospermi*, Mshl. (Bull. Ent. Res. xv. 1925, p. 342, pl. xvi. fig. 5*), which differs in the pinkish colour of the prosternum, the more slender, less strongly punctate and more distinctly carinate rostrum, and in the dense setiform clothing of the prosternal fovea of the ♂.

Subfamily CALANDRINÆ.

Trochorrhopalus dipterocarp, sp. n. (Fig. 6.)

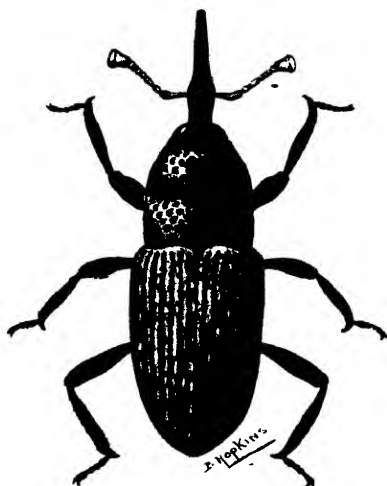
♂ ♀. Dull black or piceous, often covered with a dense earthy incrustation; the elytra with numerous small irregular patches of short golden hairs.

Head impunctate, except for a few small shallow punctures on the lower surface; the eyes distinctly separated beneath (0.05 mm.). *Rostrum* about as long as the pronotum, rather strongly curved, subparallel-sided at the base, roundly dilated above the insertion of the antennæ, thence gradually narrowing to beyond the middle, and again slightly widening to the apex; ♂ with the sculpture on the basal half hidden by an indumentum, except for a shallow longitudinal furrow on each side of the dilated area, the apical half with more or less confluent punctures leaving a narrow abbreviated smooth median line; ♀ with the lateral furrows obsolete, the punctures on the apical half smaller and separated, and without any definite median line. *Antennæ* with the two basal joints of the funicle subequal, joints 3–6 transverse, and the club a little longer than broad. *Prothorax* longer than broad, subparallel-sided from the base to the middle, then roundly narrowing to the apex and with a distinct apical constriction; the dorsum somewhat uneven, closely set with

* In the explanation of this plate the names of the two species of *Phylaitis* have been erroneously transposed; the references in the text are correct.

very large deep reticulate punctures and sometimes with a feeble median longitudinal impression in the basal half; the punctures always filled with and sometimes obliterated by an earthy incrustation. *Scutellum* small, oval, and flat. *Elytra* elongate-ovate, in ♀ widest at the obliquely rounded shoulders and very gradually narrowing behind, rather more parallel-sided in ♂, and with a distinct subapical impression on each side (often obscured); the striæ distinct throughout and containing shallow-spaced punctures which are slightly wider than the striæ; the intervals broader than the striæ, slightly convex and uneven, each with a row of varying tufts

Fig. 6.

*Trochorrhopalus dipterocarpi*, sp. n.

of dense short recumbent golden setæ, the alternate intervals being slightly higher at the base only. *Legs* covered with a dense brown indumentum having a grey sheen; the femora sparsely set with short subrecumbent golden setæ, which become erect on the lower face; the tibiæ with three dorsal lines of recumbent golden setæ and one on each side. *Underside* with a fine grey pubescent sheen and set with large separated punctures, each having a short curved seta on its anterior edge; the three intermediate ventrites with a single transverse row of longer erect setæ, the last ventrite with a large patch of dense erect setæ in the middle.

Length 6.6–9.6 mm., *breadth* 2.4–3.5 mm.

BURMA: Okkan Reserve, Insein, 2 ♂♂, 3 ♀♀, 2. i. 1927 (*D. J. Atkinson*).

The insects were bred from the wood of *Dipterocarpus alatus*.

The genotype, *T. strangulatus*, Gyll., 1837, differs from the present species in its more flattened elytra, the intervals on which lack the setose patches and the alternate ones are more elevated throughout their length. Moreover, in *strangulatus* the eyes are contiguous beneath; the antennal club is slightly broader than long; the punctures on the pronotum are much smaller, separated and not reticulate, and the median impression is much stronger; the setæ on the last ventrite are subrecumbent and not erect, etc.

Subfamily COSSONINÆ.

Himatium tectonæ, sp. n.

♂ ♀. Colour red-brown, with stout pale setæ.

Head very convex, rising abruptly from the base of the rostrum and separated from it by a shallow transverse impression containing two short erect spatulate setæ; the forehead rather coarsely punctate and with fairly dense recumbent yellowish setæ, the vertex with very shallow fine confluent punctures. *Rostrum* quite straight; in ♂, a little more than twice as long as wide and rugosely punctate throughout, the punctures being longitudinally confluent dorsally in the basal half; in ♀, of the same length but rather narrower, the dorsal punctures being finer and not confluent except close to the base. *Antennæ* with the club comparatively small, about as long as the last three joints of the funicle, and thinly clothed with setæ. *Prothorax* longer than broad (4:3), only slightly rounded laterally, widest at one-fourth from the base, gradually narrowing in front, and with a deep constriction near the apex, which is continued across the dorsum; the apical margin without any fringe of dense white setæ; the dorsum somewhat flattened in the middle, set with very shallow large reticulate punctures, which are rather larger than those on the elytra, and with fairly dense, narrow, transversely recumbent, yellowish setæ, interspersed with suberect curved spatulate setæ. *Elytra* somewhat broader at the shoulders than the prothorax, flattened dorsally as far as stria 3, the striae containing strong subquadrate punctures; the intervals flat and not wider than the striae, each with a single row of recumbent pointed setæ intercalated with a row of curved suberect

spatulate setæ, the latter wanting only on intervals 2, 4, 6 from the base to beyond the middle.

Length 2.0–2.5 mm., *breadth* 0.7–0.8 mm.

JAVA: Semarang, 2 ♂♂, 2 ♀♀, 21. ix. 1927 (*L. G. E. Kalshoven*).

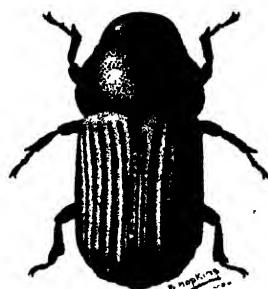
The adult beetles were found in crevices in the bark of teak (*Tectona grandis*).

Very closely related to *H. asperum*, Mshl., 1913, from Assam, which differs *inter alia* as follows:—The rostrum is distinctly broader proportionately and has four erect setæ at its base; the head is more distinctly punctate; the antennal club is larger and densely setose, being about as long as the last five funicular joints; the prothorax bears much smaller punctures (not larger than those on the elytra) with wider interspaces, and the apical margin has a very short dense white fringe except for a short distance on the dorsum.

Brachytemnus ruptus, sp. n. (Fig. 7.)

Black or piceous, the head and prothorax rather shiny, the elytra opaque with only the costæ shiny; the antennæ and tarsi red-brown.

Fig. 7.



Brachytemnus ruptus, sp. n.

Head with the vertex alutaceous and with fine sparse punctures; the forehead with strong reticulate punctures, which are much wider than the intervals between them and become longitudinally confluent in front; the eyes quite flat, the space between them as wide as the base of the rostrum. *Rostrum* much broader than long, not conical but parallel-sided, or even slightly widening to the apex, with the apical margin asymmetrically produced to the right of the middle; the scrobe much widened behind, its upper margin running to about the lower fourth of the eye; the

two median setæ on the submentum very short; the dorsum with rugose, longitudinally confluent punctures, appearing more or less carinulate. *Antennæ* with the club almost circular. *Prothorax* transverse (7:5), broadest near the base and gradually narrowing in front as far as the abrupt apical constriction, the sides being more or less sinuate in the middle and the basal angles rounded; the dorsum highest at the base and sloping forwards with a slight curve, with rather small shallow punctures that diminish but little in front, the interspaces feebly alutaceous and for the most part only slightly narrower, or even broader, than the punctures. *Scutellum* obsolescent. *Elytra* subcylindrical, slightly widening behind, twice as long as the pronotum, with rather broad sulci, which are for the most part opaque and gradually widen towards the apex; sulci 1-4 not nearly reaching the base, which is here set with rasp-like transverse granules; in sulci 1 and 2 and on the apical half of 3-6 the punctures are quite small, separated and diminishing posteriorly; in the basal half of sulci 3-5 the punctures are much larger and subquadrate, being separated by narrow transverse ridges; in the basal half of 6-8 the sulcus disappears, being replaced by a row of large punctures; the intervals mostly wider than the sulci near the base but gradually becoming much narrower behind, strongly costate and somewhat irregularly punctate, but the punctures often arranged in two rows, one on each side of the costa alternating with the other; intervals 1 and 2 broadly dilated towards the base and there coarsely punctate, the punctures changing to asperate granules basally; posteriorly, interval 1 disappears entirely at the top of the declivity, being represented behind only by a row of minute punctures; the remaining intervals only with minute obsolescent granules on the declivity, and with merely microscopic setæ. *Legs* shiny; the femora rather sparsely punctate, and with short golden setæ on the lower parts. *Underside* with the punctures on the sternum and basal ventrite rather sparse (interspaces broader than punctures), and those on the other ventrites more dense; the mesosternal process much broader than usual, being about as broad as long.

Length 3.6-4.2 mm., breadth 1.5-1.8 mm.

INDIA: Nambor Reserve, Sibsagar, Assam, 12 specimens from *Dysoxylum binectariferum*, S. v. 1921 (Dr. C. F. C. Beeson).

Readily distinguished from all the other known species of the genus by its parallel-sided rostrum, the broad mesosternal process, and the smooth space on the declivity of the elytra between the suture and interval 2.

LXIX.—*The Staphylinidæ (Coleoptera) of the Third Mount Everest Expedition.* By MALCOLM CAMERON, M.B., R.N., F.E.S.

A SMALL collection of Staphylinidæ, collected by Major Hingston, I.M.S., during the Mount Everest Expedition of 1924, has been submitted to me by the British Museum for examination and the results are here recorded.

OXYTELINÆ.

Amphichroum pindarensæ, Champ.

Several examples. Tibet: Rongshar Valley, altitude 11,000 feet, 27. vi. 1924.

Amphichroum monticola, sp. n.

Very closely allied to *A. pindarensæ*, Champ., and only differing in the following respects: a little smaller, the head more finely and more closely punctured, the antennæ distinctly shorter, with only the first three joints testaceous, the penultimate joints, and especially the last, much shorter (although distinctly longer than broad), the thorax a little shorter and more transverse, a little more finely and more closely punctured.

Length 3 mm.

♂: middle tibiæ curved and strongly sinuate internally.

Tibet: Tropde, altitude 11,000 feet, 23. vi. 1924.

Coprophilus (Zonoptilus) subplagiatus, sp. n.

Elongate, black, shining, the anterior and lateral margins of the thorax very narrowly reddish, the elytra reddish, the base and suture black, and a large indeterminate lateral spot blackish. Antennæ black. Legs reddish testaceous.

Length 5.2 mm.

Near *C. burphnensis*, Champ., but broader and more robust, antennæ a little stouter, the sides of the thorax a little more rounded in front, the anterior and lateral margins very narrowly reddish, the disc without a median sulcus, more finely punctured, elytra differently coloured and more obsoletely punctured.

Tibet: Jelap La, altitude 18,000 feet, 1. iv. 1924.

Oxytelus (Tanycrærus) hingstoni, sp. n.

Entirely black, shining. Thorax 3-sulcate. Antennæ black, the first joint pitchy. Legs with the femora pitchy, the tibiæ and tarsi pitchy-testaceous.

Length 5 mm.

Near *O. megacerus*, Fauv., but differently coloured, etc.

♀ : head narrower than the thorax, suborbicular, the post-ocular region about half as long again as the eye; clypeus declivous, the front emarginate and with a few scattered punctures; vertex even, the whole disc moderately finely and moderately closely punctured. Antennæ with the fourth joint small, the fifth to tenth transverse, the penultimate about twice as broad as long. Thorax as in *lucens*, Bernh., the sides in front evenly rounded, slightly emarginate before the obtuse posterior angles, the disc trisulcate, the lateral sulci somewhat abbreviated in front and behind, at the sides deeply and broadly impressed, the puncturation closer at the sides, not striate. Elytra a little longer than the thorax, closely punctured, scarcely striate. Abdomen almost impunctate, coriaceous.

♂ unknown.

Sikkim: Lachen, altitude 10,000 feet, 26 iv. 24.

Oxytelus (Anotylus) sikkimi, Fauv.

One example. Darjeeling, altitude 7000 feet, iii. 1924.

Osorius pectinifrons, Fauv.

One example. Darjeeling, altitude 7000 feet, iii. 1924.

Osorius sikkimensis, Bernh.

Five examples. Sikkim, Karponang, altitude 10,000 feet, 21. iv. 1924.

STENINÆ.

Stenus (s. str.) *sikkimensis*, sp. n.

Black, moderately shining; thorax and elytra with coarse confluent rugæ. Antennæ pitchy, the first two joints black. Legs black, the base of the femora and the middle of the tibiæ reddish-testaceous.

Length 5 mm.

Near *S. guynemeri*, Jacq. du Val, similarly coloured, but less shining, the antennæ a little longer, the head broader,

more broadly excavated, with a small, scarcely elevated, smooth central plaque, more evenly punctured; thorax longer, less uneven; elytra with very similar but rather coarser sculpture; abdomen much more closely and more coarsely punctured. Head nearly as broad as the base of the elytra, broadly excavated, scarcely elevated along the middle, in the centre with a small impunctate plaque, otherwise closely and coarsely punctured. Antennæ with all the joints longer than broad. Palpi testaceous, the third joint black. Thorax a little longer than broad, widest at the middle, a little more narrowed behind than in front, scarcely sulcate and scarcely impressed at the sides, with coarse confluent rugæ and punctures. Elytra a little longer than the thorax, with coarse confluent rugæ, which tend to become vorticose on the middle of the disc, and very coarse confluent punctures. Abdomen gradually narrowed from base to apex, closely and rather coarsely punctured, rather less coarsely behind. Last segment with a short spine on each side.

One ♀ example.

Sikkim: Darjeeling, altitude 7000 feet, 11-20. iii. 1924.

Pæderinæ.

Pæderus nigricornis, Bernh.

Two examples. Tibet: Rongshar Valley, altitude 9500 feet, 25. vi. 1924.

Pæderus tibetanus, sp. n.

Shining; head black, thorax and scutellum red, elytra constricted at the base, blue; abdomen red, the first (visible) and last two segments black. Antennæ and legs reddish-testaceous, the apex of the femora rather broadly infusate.

Length 9 mm.

Readily distinguished by the black first abdominal segment, with short elytra contracted at the base. Head scarcely differing in shape from *P. litoralis*, Gr., but otherwise quite different. Head as broad as the thorax, the post-ocular region gently rounded and retracted to the neck, at the sides with some moderate scattered punctures. Antennæ with all the joints distinctly longer than broad. Thorax a little longer than broad, the sides not margined, gently rounded in front, straighter and more retracted behind, sparingly and irregularly punctured. Elytra scarcely as long as the thorax, narrowed at the base and widened

behind, closely and roughly punctured. Abdomen finely, moderately closely, punctured.

♂ : posterior margin of the fifth ventral segment slightly impressed ; the sixth broadly impressed throughout nearly the whole length, the impressious more densely punctured and pubescent than the rest of the surface ; seventh with a deep narrow excision with rounded apex. Unique.

Tibet : Rongshar Valley, altitude 9500 feet, 25. vi. 1924.

Pæderus hingstoni, sp. n.

Shining ; head and thorax red, elytra blue, constricted at the base, abdomen red, the last two segments black. Antennæ and legs reddish-testaceous.

Length 6.75 to 7 mm.

Readily recognized by the colour and short elytra contracted at the base and dilated towards the apex. In build somewhat resembling *P. brevipennis*, Lac., but a little larger, the post-ocular region longer and more gradually retracted to the neck, thorax a little longer and narrower, the sides not bordered, elytra more coarsely, less closely, more irregularly punctured, more contracted at the base. Head slightly broader than long, the post-ocular region slightly rounded and gradually and evenly retracted to the neck, moderately finely and rather sparingly punctured. Antennæ with all the joints distinctly longer than broad. Thorax scarcely longer than broad, a little broader than the head, the sides evenly rounded, more retracted behind, with some rather fine scattered punctures. Elytra scarcely as long as the thorax, narrow at the base and widened behind, coarsely and irregularly punctured. Abdomen finely and rather sparingly punctured and pubescent, finely coriaceous.

♂ : fourth ventral segment scarcely, fifth and sixth broadly superficially impressed in the middle and there more closely punctured and pubescent, seventh narrowly deeply excised, the apex of the excision rounded.

Sikkim : Darjeeling, altitude 7000 feet, 11-20. iii. 1924. Several examples under stones near a dry stream.

STAPHYLININÆ.

Othius ruficornis, sp. n.

Black ; head, thorax and abdomen shining, the elytra subopaque. Antennæ reddish-testaceous, the first joint sometimes pitchy. Legs reddish-testaceous.

Length 11 mm.

About the size and build of *O. punctulatus*, Gozis, but with larger head. Head a little longer than broad, the sides scarcely dilated behind the eyes, the posterior angles rounded, the front bi-impressed, each impression with three or four setiferous punctures, otherwise impunctate; middle of the disc impunctate, towards the sides and base with some moderately large and rather close punctures, the whole surface finely but distinctly coriaceous. Antennæ with the penultimate joints as long as broad. Thorax cylindrical, near the anterior angles with four or five punctures, otherwise impunctate, ground-sculpture as on the head. Elytra scarcely as long as the thorax, parallel, finely moderately closely punctured, densely and much more strongly coriaceous than the fore-parts. Abdomen finely, moderately closely punctured, finely coriaceous.

Sikkim: Karponang, altitude 10,000 feet, 20. iv. 24. Two ♀ examples.

Philonthus poëphagus, sp. n.

Shining, black, the thorax with a dorsal row of three punctures on each side, the elytra brilliant metallic magenta. Antennæ and legs black.

Length 11 mm.

Scarcely differing from *P. chalceus*, Steph., in build, except that the posterior angles of the head, though rounded, are more evident, and the eyes are smaller; the antennæ are shorter, but similarly constructed. The thorax has on either side of the middle a series of three equidistant punctures, the first of them on the anterior border, externally with a curved row of three or four more. Both the head and thorax have an extremely fine, scarcely perceptible, puncturation, but no ground-sculpture. Scutellum finely and closely punctured, black. Elytra as long as the thorax, rather finely but much less closely punctured than in *chalceus*, with traces of two rows of larger punctures. Abdomen on the anterior segments with straight basal line, rather finely, moderately closely, punctured, with black pubescence. ♂: anterior tarsi dilated; sixth ventral segment with a small triangular excision.

Tibet: Rongshar Valley, altitude 15,000 feet, 2. vii. 1924; Ling-ka, 14,000 feet; Kampa Dzong, 14,500 feet, 29. iv. 1924. In Yak dung. In the single example from the last place, the elytra are coppery with traces of purple reflex, their puncturation not so fine and the rows of punctures scarcely visible.

Philonthus carbonarius, Gyll.

One example. Darjeeling, altitude 7000 feet, 11-20. iii. 1924.

Philonthus proximatus, Schub.

One ♂, 8.5 mm. in length and with less greenish, more coppery elytra, appears to be referable to this species.

Sikkim : Rongli Chu, altitude 3000 feet.

Philonthus azuripennis, sp. n.

Shining, head and thorax bright bronze-green, the latter with a dorsal series of four punctures on either side ; elytra blue or greenish blue ; abdomen black. Antennæ, palpi, and legs black.

Length 9 mm.

In build scarcely differing from *P. chalceus*, Steph., but the head not quite so broad, the colour different, the antennæ longer, the basal line on the anterior abdominal segments straight, and different ♂ characters.

♂ : head transverse, subquadrate, the posterior angles rather broadly rounded, not quite so broad as the thorax, the front with feeble median impression, and the usual four intra-ocular punctures ; post-ocular region rather more closely punctured than in *chalceus*, the ground-sculpture similar. Antennæ reaching the base of the elytra, the penultimate joints fully as long as broad. Thorax as in *chalceus*. Scutellum black, more sparingly punctured than in *chalceus*. Elytra as long as the thorax, closely and rather finely punctured. Abdomen rather closely punctured, pubescence black, fifth ventral segment with a small crescentic emargination ; sixth with acute triangular impression, and deep acute triangular excision. Anterior tarsi strongly dilated. ♀ : unknown.

Tibet : Gantsa, altitude 13,000 feet (5. iv. 1924) ; Jelap La, 12,000 feet (1. iv. 1924). Sikkim : Tangu, 14,000 feet (27. iv. 1924) ; Dentang, 15,000 feet (27. iv. 1924).

Philonthus riparius, Cam.

Tibet : Yatung, altitude 10,000 feet (16. iv. 1924). Sikkim : Karponang, 10,000 feet (20. iv. 1924).

Philonthus tractatus, Epp.

Tibet : Rongshar Valley, altitude 11,000 feet, 27. vi. 1924. Two ♂ examples.

Philonthus yatungensis, sp. n.

Shining, black, the elytra with metallic-green reflex. Thorax with dorsal row of four punctures on each side. Antennæ, palpi, and legs black.

Length 7 mm.

Closely allied to *P. sordidus*, Gr., but a little larger and more robust, blacker, the antennæ shorter and stouter, the penultimate joint more transverse, puncturation of the elytra a little finer. Abdomen rather more sparingly punctured, and with black pubescence; the ground-sculpture on the head and thorax is similar to that of *sordidus*, so also are the dorsal thoracic punctures.

♀ : head subquadrate, as broad as the thorax, post-ocular region one and a half times longer than the eye; penultimate joints of the antennæ twice as broad as long.

Tibet : Yatung, altitude 10,000 feet, 23. vi. 1924. One ♀.

Philonthus obsoletus, Epp.

Sikkim : Lachen, altitude 9000 feet (26. iv. 1924).

Tibet : Rongshar Valley, altitude 10,000 to 11,000 feet (vi. 1924).

Philonthus convalescens, Epp.

Sikkim : Darjeeling, altitude 7000 feet (11-20. iii. 1924); Phadam Chen, 7000 feet (30. iii. 1924). Two examples.

Tibet : Tropde, altitude 11,000 feet.

Philonthus nigricoxis, sp. n.

Very near *P. longicornis*, Steph., but differing in the anterior coxæ being entirely deep black, as also are the palpi and antennæ, the penultimate joints of the latter are a little shorter, the head also is a little shorter, the elytra rather more finely punctured. The antennæ are constructed as in *peregrinus*, Fauv., but the head is shorter and broader, and the elytra more closely and less squamosely sculptured than in that species; moreover in *peregrinus* the anterior coxæ are pitchy, darker externally and lighter within. The ♂ characters scarcely differ from those of *longicornis*.

The length is 5 mm.

Sikkim : Karponang, altitude 10,000 feet (24. iv. 1924).

Tibet : Tuna, altitude 14,500 feet (9. iv. 1924).

Staphylinus olivaceus, sp. n.

Subopaque, the fore-parts olive-green, the head with the

inter-ocular margin narrowly reddish, on each side at the base with small reddish spot covered with a scanty silvery pubescence; clytra rather darker than the head and thorax, and mottled with a silvery pubescence; abdomen olive-brown, thickly mottled with silvery pubescence, distinctly bifariate on each segment except the last. Antennæ black, the first joint more or less reddish. Legs black, the femora, especially the upper surface, more or less reddish.

Length 12.5 to 14 mm.

Very distinct by its colour. In build scarcely differing from *S. prainæ*, Epp. Head subquadrate, slightly broader than the thorax, the posterior angles rounded, the temples slightly longer than the eyes, the whole surface rather closely and rather finely punctured, coriaceous, the temples covered with silvery hairs, at the middle of the base with a narrow line of similar pubescence (often obscure). Antennæ with the penultimate joints slightly transverse. Thorax slightly longer than broad, the sides straight, more retracted behind, the posterior angles rounded; sculpture as on the head; before the base with a short shining median line, scutellum black, tomentose, with narrow median yellowish line. Elytra as long as the thorax, of a darker tint than the head and thorax, very similarly sculptured, distinctly marbled with silvery lines and spots. Abdomen with a silvery fascia along the whole of the middle line, very distinctly bifariate, brown, the sides silvery pubescent.

♂: sixth ventral with a small triangular impression, its base crescentically excised.

Sikkim: Lachen, altitude 8500 to 9000 feet (25-26. iv. 1924); Tangu, altitude 11,500 feet (26. iv. 1924). Five examples.

Staphylinus prainæ, Epp.

Sikkim: Darjeeling, altitude 7000 feet (iii. 1924); Kalimpong, altitude 4000 feet (27. iii. 1924); Phadam Chen, altitude 7000 feet (30. iii. 1924); Gantok, altitude 5000 feet (9. v. 1924).

Ocypus (Pseudocypus) aereus, sp. n.

Head, thorax, and elytra shining brassy-bronze; abdomen less shining, black. Antennæ and legs black.

Length 12.5 mm.

In build very similar to *O. fuscatus*, Gr., but the head less broadly rounded behind the eyes, more quadrate, the head and thorax more brassy, the elytra much more shining, less pubescent, the abdomen blacker, the antennæ shorter. Head

subquadrate, almost as broad as the thorax, the posterior angles briefly rounded, the temples distinctly shorter than the eyes, the puncturation fine, more uniform than in *fuscatus*, moderately close, but more sparing along the middle. Antennæ rather short, the penultimate joints distinctly transverse. Thorax as long as broad, a little wider behind, the sides almost straight, the posterior angles broadly rounded, somewhat irregularly sculptured with fine and very fine punctures, impunctate along the middle. Elytra as long as the thorax, with two large punctures on each, one near the middle of the base, the other a little in front of the posterior margin, very finely, somewhat indistinctly, moderately closely, punctured, finely and sparingly pubescent. Abdomen with some irregular impressions towards the sides of the segments, very finely, rather closely punctured, black pubescent.

♂ unknown.

Sikkim: Tangu, altitude 11,500 feet (26. iv. 1924). One example.

Craspedomerus violaceipennis, sp. n.

Head and thorax shining brassy-bronze; elytra less shining, metallic violet; abdomen black, slightly iridescent, the whole of the last and the posterior half of the preceding segment reddish-testaceous. Antennæ black, the eighth, ninth, and tenth joints pale yellow. Legs reddish-testaceous.

Length 11 mm.

Distinct from all others by the colour of the elytra and antennæ. ♂: head large, transverse, subquadrate, slightly broader than the thorax, the posterior angles rounded, the temples a little longer than the flat eyes; the sides and base moderately finely and moderately closely punctured in the middle, and on the front practically impunctate; ground-sculpture fine, wavy, subtransverse. Antennæ with all the joints longer than broad, gradually decreasing in length from the third, the penultimate not much longer than broad. Thorax a little longer than broad, the sides straight and parallel, the posterior angles broadly rounded; along the middle with a broad impunctate space, the rest of the surface rather closely and moderately finely punctured like the head. Scutellum finely and closely punctured, black. Elytra as long as the thorax, very finely and closely punctured, finely and closely pubescent. Abdomen very finely, moderately closely, punctured, more sparingly behind, black pubescent. Sixth ventral segment with a small

crescentic impression, its base with a small notch. Anterior tarsi strongly dilated.

♀ : head smaller, less transverse, as broad as the thorax ; anterior tarsi less dilated.

Sikkim : Karponang, altitude 10,000 feet (20. iv. 1924) ; Phadam Chen, altitude 9000 feet (30. iii. 1924). Tibet : Chumbi Valley, altitude 11,000 feet (2. iv. 1924) ; Yatung, altitude 10,000 feet (16. iv. 1924). Several examples.

Algon semiaereus, sp. n.

Shining ; head, thorax and elytra black, abdomen brassy-bronze. Antennæ with the first four joints pitchy-brown, the rest testaceous. Legs pitch-black.

Length 12 mm.

Head subtriangular, narrower than the thorax, the posterior angles rounded, very finely, moderately closely, punctured at the sides and base, almost impunctate elsewhere. Antennæ rather short, the penultimate joint as long as broad. Thorax large, convex, almost as long as broad, widest behind at the broadly rounded posterior angles, and narrowed gradually towards the front, with a very fine, scarcely perceptible, scattered puncturation. Elytra shorter and narrower than the thorax, transverse, with an irregular, moderately fine, close puncturation. Abdomen parallel, rather closely and moderately coarsely punctured at the bases of the segments, more finely elsewhere. Sixth ventral segment with slight crescentic emargination. Anterior tarsi dilated.

Sikkim : Darjeeling, altitude 7000 feet (11-20. iii. 1924). One example.

TACHYPORINÆ.

Tachyporus montanus, Bernh.

One example, agreeing with the description of this insect.

Sikkim : Darjeeling, altitude 7000 feet (11-20. iii. 1924).

Tachyporus triangulum, sp. n.

Shining reddish-testaceous, the thorax slightly infusate along the middle ; elytra with a large well-defined triangular marking, extending from the middle of the base to the apex of the suture ; abdomen blackish behind. Antennæ and legs testaceous. Palpi with the third joint slightly infusate.

Length 4 mm.

Size and build of *T. obtusus*, L. Head and thorax without sculpture. Antennæ with the penultimate joint a little longer than broad. Elytra a little longer than the thorax, extremely finely and sparingly punctured and pubescent, at each side with five black setæ. Abdomen very finely, moderately closely, punctured, finely pubescent, the sides and apex with long black setæ.

Sikkim: Gantok, altitude 5000 feet (6. v. 1924). One specimen.

Tachinus maculipennis, sp. n.

Moderately shining, black; the sides of the thorax rather narrowly testaceous; the elytra with a moderate ill-defined humeral testaceous spot, and the posterior margin very narrowly testaceous. Antennæ black, the first four joints pitchy. Legs reddish.

Length 4 mm.

Of the build of *T. humeralis*, Gr., but much smaller. Head exceedingly finely, rather sparingly punctured, with a fine retiform ground-sculpture. Antennæ reaching the middle of the elytra, the fourth joint much shorter than the third, fifth to tenth all longer than broad, gradually decreasing in length, the penultimate only slightly longer than broad, the eleventh long, oval, longer than the two preceding together. Thorax transverse, the sides rather strongly rounded, the sculpture as on the head. Elytra twice as long as the thorax, with a very similar sculpture. Abdomen gradually narrowed behind, the punctuation more distinct than on the fore-parts, the ground-sculpture very similar.

♂: fifth ventral segment broadly impressed along the middle throughout, the posterior margin corresponding broadly triangularly emarginate, and closely denticulate, the posterior and wider part of the impression granular. Anterior tarsi with the first two joints dilated.

Tibet: Rongshar Valley, altitude 11,000 feet (27. vi. 1924). One ♂ example.

Tachinus lugubris, sp. n.

Entirely black, shining. Antennæ black, the first two joints pitchy. Legs reddish.

Length 4 mm.

In build and size scarcely differing from *T. fimetarius*, Gr. The head is scarcely perceptibly punctured, with a fine wavy ground-sculpture. Antennæ reaching the base of the thorax, the penultimate joints a little longer than broad, the eleventh long, oval, as long as the two preceding together. Thorax with sculpture as on the head. Elytra half as long

again as the thorax, very finely, not closely, punctured, the ground-sculpture stronger than on the thorax. Abdomen not strongly narrowed behind, the sculpture as on the elytra.

♂ : eighth dorsal segment divided into four lobes, the central pair longer and narrowed to the rounded apex, separated from each other by a narrow excision ; outer lobes short, separated from the inner by a small rounded emargination. Fifth ventral segment with a broad and deep semilunar excision, the narrow area bounding it closely granular and with six sharp spines at each end. Anterior tarsi with the first two joints dilated.

Sikkim : Darjeeling, altitude 7000 feet (1-10. iii. 1924). One ♂ example.

Coproporus himalayicus, Cam.

Sikkim : Darjeeling (11-20. iii. 1924). Four examples.

ALEOCHARINÆ.

Atheta (Metaxya) lugubris, sp. n.

Black, greasy lustrous. The antennæ and legs reddish brown.

Length 3.5 mm.

Build of *A. gracilicornis*, Kr., but much larger and entirely black. Head subquadrate, as broad as the thorax, the middle of the disc deeply foveate, scarcely perceptibly punctured, rather strongly coriaceous, finely and sparingly pubescent. Antennæ long and slender, the third joint longer than the second, fourth to tenth all longer than broad, gradually decreasing in length, the penultimate not much longer than broad, eleventh elongate, oval, nearly as long as the two preceding together. Thorax formed as in *gracilicornis*, a good deal narrower than the elytra, broadly impressed in the middle for about the posterior half ; sculpture as on the head. Elytra half as long again as the thorax, the sculpture as on the fore-parts. Abdomen slightly narrowed behind, finely, not very closely, punctured, the ground-sculpture as on the fore-parts, finely, sparingly pubescent.

♂ : seventh ventral segment produced, gently narrowed and rounded ; eighth dorsal segment very slightly, broadly emarginate,

Tibet : Lamna La, altitude 17,000 feet (17. vi. 1924). One ♂ specimen.

Astilbus obliquus, Bernh.

Sikkim : Pedong, altitude 6000 feet (26. iii. 1924). Four examples.

LXX.—*The Evolution of Cycles and the Origin of Heteracy (Migrations) in Plant-Lice.* By A. MORDVILKO.

THE plant-lice originated in a moderate climate. Such a statement is before all based upon the fact that the great diversity of forms (subfamilies, tribes, genera) is observed in moderate latitudes, whereas in Tropics the number of groups and genera decreases considerably, and there are no endemic genera that do not occur in subtropical or even moderate climates as well. Moreover, plant-lice are characterised by the heterogeny—i. e., a succession of virgin generations with one amphigon terminating the cycle. However, in Tropics the bisexual generation falls out entirely, and this is undoubtedly a secondary phenomenon, the reproduction of plant-lice having originally been only bisexual. Thus, for instance, some species of plant-lice in Japan have a bisexual generation, whereas in the island of Formosa it falls out entirely, or almost entirely, sometimes only males appearing (R. Takahashi, 1921–1924); sexual forms of plant-lice in Java are not known at all (P. van de Goot, 1917). Plant-lice appear to have penetrated into Tropics in a secondary way.

At the beginning there existed in plant-lice but two forms of individuals, winged females and winged males, and several generations a year. Winged males are still rather common in various subfamilies of the family Amphididae, only Pemphiginæ making exception; winged females (simultaneously with winged males) occur only in isolated species, though belonging to different subfamilies. They are as follows: Of the subfamily Callipterinae: *Tamalia coweni*, Cockerell, from Colorado and California (C. P. Gillette, 1909); *Neophyllaphis podocarpis*, Takah., from Japan (Takahashi, 1923); *Drepanosiphum californicum*, sp. n. (= *platanoides*, Wilson, 1909), from California. Of the subfamily Greenideinae: *Greenidea kuwanai*, Perg., and *G. tenuicarpus*, Okajima, from Japan (Takahashi, 1923). Of Cervaphidinae: *Cervaphis quercus*, Takahashi (1918, 1923), from Japan (and Formosa). Of Pemphiginæ: *Phæomyzus passerinii*, Signoret, from the Palearctic (Cholodkovsky, 1919, 1921). All the above are relics of the past, when the bisexual generation (males as well as females) was only winged, or even of those times when in all plant-lice existed but bisexual reproduction and only winged individuals. Later on, the spring and summer generations gave way gradually to virgins, whereas of the bisexual ones only

one generation persisted terminating the cycle of generations. Thus originated the first complication of the cycle, heterogony. Of course, at the beginning, virgins were oviparous in all plant-lice, as it is now the case with Chermesidæ, and they were winged like all virgins now (including the fundatrices) in many genera of the tribe Callipterea of the subfamily Callipterinæ (*Euceraphis*, Walk., *Drepanosiphum*, Koch, *Tuberculatus*, Mordv., and others).

Chermesidæ and Aphididæ are now two distinct groups; each of them maintained some peculiarities of the ancestors and modified the others to a different degree in each group. Thus, for instance, in Chermesidæ the antennæ, even in winged individuals, became shorter and the number of their segments decreased to three instead of five segments, the last three segments being separated from each other only by compressions instead of articulations, which, however, may indicate that originally there were at least five segments. In winged Chermesidæ the fore wings are bearing but three oblique veins, and even the media is simple; the hind ones possess but one oblique vein or even no veins at all. This is no doubt a phenomenon of secondary reduction. In Chermesidæ, the abdomen is bearing neither eight pairs of stigmata, like other Hemiptera, nor even seven, like Aphididæ, but six or five pairs. All these peculiarities of Chermesidæ are secondary phenomena produced by the reduction of the size of the body. The ancestors of Chermesidæ possessed more fully veined wings and longer antennæ, and at least seven pairs of stigmata on the abdomen. They were also larger in size. The evolution of Chermesidæ thus proceeded parallel to their decrease in size; in Chermesinæ it seems to be connected with the transition of some generations to living upon *Picea* galls with their very small cavities between scales. From their ancestors the Chermesidæ conserved oviparous virgins and fairly developed gonapophysal apparatus (primary characters). Living Chermesidæ could not, of course, produce forms with more perfectly veined wings, with larger number of abdominal stigmata, etc.

Aphididæ inherited from their ancestors more complete venation of the wings, the media often consisting of three branches, a larger number of pairs of stigmata (namely, seven), and longer antennæ (six segments, as a rule). But their virgins became viviparous; the gonapophysal apparatus of females and virgins was reduced to hardly distinguishable structures; a series of new characters appeared.

The division of plant-lice into Chermesidæ and Aphididæ must have occurred when all the forms of individuals were

still winged and virgins oviparous, and still more probably when only winged sexual individuals of plant-lice were existing. However, in such case all other later modifications of the cycles had to proceed either quite independently in each family or parallel, without any modifications inherited from their ancestors.

Various subfamilies of Aphididæ differentiated very early; in any case they were distinguishable as such already at the time when all individuals were winged, otherwise it would not happen that in various subfamilies, though in isolated species, winged males and females are still existing, and in many genera of the tribe Callipterea winged fundatrices. Even the subdivision into tribes occurred very early when all individuals were winged. Of the tribe Pemphigea (subfamily Pemphiginæ) males and females of the genus *Phleomyzus*, Horvath, are winged, which means that in the whole tribe males and females were originally winged, whereas now they are larviform and without the proboscis in all other genera, the evolution of sexual individuals having thus followed its own way in *Phleomyzus*, on one side, and in other genera of the tribe Pemphigea, on the other. In the family of Pemphiginæ, the tribes Eriosomea (connected with Ulmaceæ) and Fordea (connected with *Pistacia* and *Rhus*) might have differentiated when sexual individuals of all the Pemphiginæ were only winged, and consequently the evolution of their cycles proceeded independently. If in one tribe, namely in Callipterea, of the whole subfamily of Callipterinæ persisted, though in single species, winged males and females and winged fundatrices, it means that the subdivision into tribes of the subfamily Callipterinæ (*Mindarcea*, *Vacunea* [including subtribes *Vacunina* and *Hormaphidina*] and *Callipterea*) occurred at the time when all forms of individuals were winged, while later on the evolution of cycles in each tribe proceeded independently, yet parallel in various respects.

Thus, any change in the cycles of generations in each subfamily, even in each tribe and in single genera, occurred quite independently from their origin, and parallel.

Reproduction (increase in the number of individuals) and propagation (winged individuals) fell to the lot of virgins, whereas amphimixis was mainly the share of the bisexual generation. Thanks to reproduction of virgins, the number of sexual individuals was so large by the end of the season that it became indifferent for the species whether females would be flying and whether the quantity of eggs laid by the latter would be large. Therefore, females were the first

to lose their wings (males, searching for females, still maintained them); males lost them later on (the multitude of individuals at certain places was in any case a guarantee for amphimixis); in the course of time sexual individuals could become small in size and larviform (Chermesinæ, *Anæcia*, Koch, a parallelism), and, finally, deprived of proboscis (Phylloxerinae of the family Chermesidæ, Pemphiginæ of that of Aphididæ, another case of parallelism).

In their turn virgins began to differentiate. The development of wings and of wing-muscles requiring an expenditure of plastic material, it is possible that wingless virgins could produce a more numerous posterity than winged ones, and, in the case where there is sufficient food and no need to secure it, virgins may readily lose wings; should virgins produce a sufficiently numerous progeny, the abundance of food would enable the species to enjoy more completely the favourable conditions of nutrition. As the latter are particularly common to spring, the fundatrices, sooner than other virgins, become wingless. At present, winged fundatrices exist only in several genera of the tribe Calliptera: *Euceraphis*, *Drepanosiphum*, *Tuberculatus*, and others. Later on, summer virgins also begin to change into wingless ones. All summer virgins in many genera of Calliptera remain winged, though in other cases summer colonies consist both of winged and wingless virgins, either mixed or one kind prevailing over the other. At the beginning the wingless fundatrices are little differing from wingless virgins, but with time they change more and more, till they change into little movable clumsy sacks with feebly developed organs of motion and senses, but with very high fecundity, strongly exceeding that of all other virgins.

Such is the direction in which the evolution of the cycle of generations in plant-lice proceeded and is proceeding, *i. e.* from several nearly identical generations of winged sexual individuals first to heterogony, later on to loss of wings in females, then in males, and almost simultaneously in fundatrices as well, and, finally, in virgins of other generations. More considerable changes are observed on the one hand in fundatrices, on the other in sexual individuals, and of the latter firstly in females. Though in different groups of plant-lice the evolution of cycles proceeded independently in each group and, so to speak, parallel, yet it proceeded uniformly: in different groups independently, yet in one and the same direction, changes proceeded in sexual individuals; independently and in the same direction changed fundatrices and summer virgins as well; of all the virgins in

different groups fundatrices changed most. There are no plant-lice more of which only winged sexual individuals should exist now, neither such of which all virgins would be simultaneously winged and oviparous (whereas winged bisexual individuals are existing). The least changed cycle of generations among now living plant-lice is being observed in *Drepanosiphum californicum*, in which all forms of individuals seem to be winged. They are followed by other *Drepanosiphum*, the species *Euceraphis*, *Tuberculatus*, and others, in which all virgins and males are winged, whereas females are already wingless; further on, such as *Callipterea*, in which fundatrices become wingless too; finally, various other plant-lice. In some of them the evolution of cycles is much advanced, for instance, in different Pemphiginae, in which sexual individuals became small and lost the proboscis, while fundatrices transformed into little movable clumsy sacks; in other plant-lice the evolution of cycles occupies a median position, in others it is still just at the beginning.

Save for a few forms, plant-lice dwell on Coniferæ and Anthophyta (Angiospermæ), to begin with the most ancient types, such as Salicales, Juglandales, Ranunculaceæ, etc., ending with the most recent, such as Umbelliferæ, Compositæ, etc. All these plants having made their appearance in the history of the earth at different dates, some of them earlier and others later, a conclusion may be drawn that, as long as the Rosaceæ did not appear, no appropriate forms of plant-lice existed. Neither were there plant-lice forms common to Umbelliferæ or Compositæ until either of these plants appeared on earth. On the other hand, the origin of plant-lice in general must be referred to very remote times; they occurred already in Upper Jurassic (*Genaphis*, Brodie, cf. Handlirsch, 1908), and they existed still earlier. Therefore, the evolution of plant-lice ran parallel to the evolution of plants, and some groups of plant-lice accomplished their evolution together with some groups of plants: Chermesinae with Abietinae; Lachninae with Cupressinae and Abietinae; Pemphigea with *Populus*; Eriosomea with Ulmaceæ; green *Macrosiphum* mainly with Rosaceæ, black *Macrosiphum* with Campanulaceæ and Compositæ, etc.

In what way proceeded the peopling by plant-lice of new groups of plants, the conquest of new hosts? It cannot be imagined otherwise than in the form of removal from more ancient plants to new ones, more or less suitable, yet still continuing to live upon the old ones. However, on new plants plant-lice were able to modify and differentiate further on, they were able to open a new series of forms. At the

beginning *Pemphigea* were connected with *Populus*; however, when Rosaceæ (*Cratægus*, *Pyrus*, and other Pomoidæ) and Aceraceæ (*Acer saccharinum*) appeared, the comparatively little specialised of *Pemphigea* (for instance, *Pachypappa*, *Asiphum*) could move to the above plants and become here modified (genus *Prociphilus*; when still later Oleaceæ (*Fraxinus*, *Syringa*) and Caprifoliaceæ (*Lonicera*) appeared, it enabled *Prociphilus* to move to the latter plant and here differentiate into new species. The genus *Chaitophorus*, Koch, was originally connected with Salicaceæ; when Aceraceæ appeared in the history of the earth, it partly removed to the latter and became somewhat changed (genus *Chaitophorinella*, v. d. Goot). Callipterea were originally to a considerable degree connected with Myricales, Juglandales, Fagales; when still later on appeared Rosaceæ (*Spiræa*), Papilionaceæ (*Trifolium*, *Ononis*, *Medicago*, *Caragana*) Tiliaceæ (*Tilia*), they partly removed to those plants as well. *Macrosiphum* particularly differentiated upon Rosaceæ (green forms); when Campanulaceæ and Compositæ appeared it also moved to the latter plants and gave here new forms (black *Macrosiphum* or *Megalosiphum*). The green *Macrosiphum gei*, Koch, is also dwelling upon a more ancient host (*Genm urbanum*, Rosaceæ), as well as upon the new ones (*Chærophyllum* and *Anthriscus*, Umbelliferae), though upon the latter it did not so far differentiate even into a distinct species.

However, the removal of a species to new plants cannot be performed at any stage of the evolution of cycles with equal facility. The more simple is the cycle, the less strongly differ various virgins from each other, the easier is the removal of plant-lice from one plant to another, for should any virgin get accustomed to a new plant, it is evident that such would be the case of every other virgin, either wingless or winged (very often both develop from one and the same kind of larva). If the fundatrix is not very strongly modified in comparison with wingless summer virgins, it will easily get accustomed too. On the contrary, the more strongly various forms of individuals differ from each other, the more difficult is the removal of a species to new plants; and in the latter case the degree of change of the fundatrix is of particular importance, because it may happen that a new plant, while being suitable to little differentiated summer generations may prove unfit for fundatrices which are strongly differentiated in conformity with spring conditions of life upon a given plant, when, for instance, they provoke twisting of leaves or their thickening (galls): such

special conditions of life can hardly be repeated upon new plants belonging to quite different groups.

The new situation will be as follows: Summer generations of virgins and the bisexual generation may develop upon ancient hosts as well as upon new ones, hibernating eggs may be laid anywhere, with larvæ of fundatrices hatching in spring. But, whereas on former hosts the fundatrices would develop and open a new cycle of generations, on new plants they would find no appropriate conditions of life and would perish. However, new plants may be peopled again by winged virgins, open here a new series of generations, but fundatrices should perish again provided sexuparæ would remain on new plants. Yet not all winged sexuparæ which appeared on new plants would remain upon them, a part of them may return to ancient hosts. In the latter case fundatrices hatched from hibernating eggs will be able to develop and open a new cycle of generations; and so it will be from year to year. In the result of a long selection of sexuparæ flying from new hosts back to old ones, it will happen that, finally, all sexuparæ developed upon new hosts will fly back to old ones. It will mean a *facultative* migration, when on the one hand the whole cycle of generations will be performed on the primary host, while, on the other, part of generations, to begin at least with the third or fourth, could develop on the secondary host, till the appearance of sexuparæ that would fly back to the primary host.

However, in single cases, there may be another ground for facultative migration. Should a fundatrix of *Siphonaphis padi*, L., be unable to develop on some *Poa*, the fundatrix of *Aphis evonymi*, Fab., or *A. fabæ*, Scop., could develop on the leaves of *Rumex*. And it is possible that a fundatrix of *Macrosiphum rosæ*, L., may develop on Dipsacæ, provided it will be transferred to the latter, and a fundatrix of *Siphocoryne pastinacæ*, L., to *Conium maculatum* or any other of Umbelliferae. Nevertheless, the whole cycle in such facultatively migrating plant-lice is connected only with their primary hosts. I observed (1909) in the pea aphid (*Acyrtosiphon pisi*, Kalt.) a peculiarity that, when in the middle of August oviparous females begin to appear upon *Onobrychis sativa* and other perennial Papilionaceæ (*Trifolium*, *Medicago*, *Lathyrus*), the parthenogenesis continues proceeding upon the pea, and, in general, as long as the bisexual generation did not appear upon the pea, oviparous females, at least, were never observed. It means that if hibernating eggs of pea aphid were laid upon the

pea, fundatrices of the latter could not appear on that plant. Thus, in the case of pea aphid, a facultative migration seems to take place from perennial *Onobrychis*, *Medicago*, *Lathyrus*, and others to the pea. However, as I learned from my experience already in 1903, fundatrices can develop upon the pea provided they are assisted. Similar conditions may be observed perhaps in the case of different facultatively migrating Aphidinae, especially while fundatrices are still little differing from wingless summer virgins. In order to establish it, corresponding experiments ought to be carried out with *Macrosiphum roseæ*, L. (Rosa and Dipsacæ). *Siphocoryne pastnacæ*, L. (*caprææ*, F.) (Salix and Umbelliferae), *Anuraphis cardui*, Koch (Prunus and Compositæ: *Carduus* and others), etc. In this case we should have another ground for heterœcy in plant-lice: oviparous females cannot develop upon secondary hosts, whatever may be the reason of it. In such cases heterœcy would occur before fundatrices, in the course of evolution of a cycle of generations, be subject to such changes as to connect them definitely with their primary hosts. However it may be, in the majority of cases of regular migrations (in Chermesinae, Pemphiginae, Hormaphidina of *Vacunea*, various Aphidinae, and others) the latter were preceded by considerable changes in fundatrices.

Facultatively migrating species can, in time, split into two, quite independent, series of generations—a migrating and a non-migrating one, a regularly migrating form, and an autœcious one. Both forms, being of directly common origin, will be very close to each other, hardly distinguishable. As an established example of such closely related forms, we may point out to *Eriosoma rileyi*, Thomas, which is developing upon shoots of *Ulmus americana* (N. America) and does not migrate anywhere, and *Eriosoma lanigerum*, Hausm., which migrates from *U. americano* to some Pomoidæ, like *Sorbus americana*, *Cratægus*, *Malus*, etc., developing in summer upon their shoots and in the chinks of the bark (N. America, Mordvilko, 1924). It may happen that two closely related forms should be found among the above forms with facultative migration, but this question was so far left without attention.

However, of the two species of common origin—autœcious and heterœcious—the former is unable to persist a long time, and, for instance, among various Chermasinae, Pemphiginae, Hormaphidina, etc., parallel autœcious species do not exist at all. Their conditions of life seem to never have been so good as those of heterœcious species. And, in fact, secondary hosts very often prove to be either roots of various

plants or superterranean parts of herbaceous plants, whereas a simple observation shows that in summer plant-lice seem to be depressed on woody plants (which are their primary hosts) and unable to multiply, while on herbaceous ones and on roots they multiply successfully (Mordvilko, 1901, 1907-9). Thus, the non-migrating form will happen to be in less favourable conditions of life in comparison with the migrating one, and finally perish.

The hypothesis exposed here on the origin of heterœcy in plant-lice requires that primary hosts of plant-lice should be more ancient than secondary (intermediary) ones. Such is generally the case. Some of *Pemphigea* from *Populus* migrate to superterranean parts and roots of Compositæ (*Pemphigus filaginis*, Boyer de F., migrates to *Filago* and *Gnaphalium uliginosum*; *P. lactucarius*, Pa-s [= *pyriformis*, Licht., *bursarius*, Tullgr.], to roots of *Lactuca*, *Sonchus*, *Bidens*); *Eriosoma lanigerum*, Hausm., from *Ulmus americana* to superterranean parts of some Pomoideæ; *Tetrancyra ulmi*, Deg., to roots of various Gramineæ; *Anuraphis cardui*, Koch, from *Prunus* to stems of some Compositæ (*Carduus*, *Senecio*, etc.); *Siphocoryne pastinacæ*, L., from *Salix* to stems and umbels of various Umbelliferæ, etc. Of the samples given here, *Populus*, *Ulmus*, *Salix* belong to the oldest plant-types, Pomoideæ and Prunoideæ (Rosaceæ), Gramineæ to intermediary ones, whereas Umbelliferæ and Compositæ to more recent plants (N. I. Kuznetsov, 1920).

Thecabius, Koch, migrates from *Populus nigra* and some others (*P. suaveolens*, *P. maximoviczii*) to superterranean parts of *Ranunculus repens*, *R. flammula*, etc. Salicaceæ as well as Ranunculaceæ, according to N. Kuznetsov (1920), belong to most ancient types of vegetation, yet Salicaceæ seem to be older than Ranunculaceæ. All Chermesine from *Picea* migrate to various other Abietinæ: *Abies*, *Tsuga*, *Pinus*, *Larix*. As to *Pinus* and *Larix*, botanists (e. g., Potonié, 1921) agree in recognizing them as most recent of Abietinæ, only *Abies* seeming doubtful; however, so long as the contrary is not proven, *Picea* may be considered even older than *Abies*.

In various other cases the relative age of primary and secondary hosts remains doubtful. *Metopolophium dirhodum*, Walk., from *Rosa* (Rosales are plants of medium age) as well as *Siphonaphis padi*, L., from *Prunus* (fam. Rosaceæ), migrate to various Gramineæ; *Hyalopterus pruni*, Fabr., from Prunoideæ to Phragmites; *Rhopalosiphum loniceræ*, Sieb., from *Lonicera* (Caprifoliaceæ, according to N. Kuznetsov, belong to most recent vegetative types), migrates to *Phalaris* (Gramineæ are vegetative types of medium age).

However, it happens also that some plant-lice migrate from more recent plants to ancient ones; this is particularly in the cases where plant-lice migrate to roots. These facts need explanation. All the plant-lice are parasites upon superterranean parts of plants, and there is no species that would accomplish the whole cycle of generations (including the bisexual ones) upon roots. It may depend upon the fact that the cycle of generations is closed by a bisexual generation and hibernating eggs, the latter being unable to hibernate on roots. This may be clearly observed in the case of *Phylloxera vastatrix*. Whereas eggs laid by females of the bisexual generation upon the bark of grape-vine hibernate there, there are no eggs laid by virgins that would hibernate on roots, but only hatched larvæ, not moulted. Of various other plant-lice (migrating) young virgins are generally hibernating on roots. Eggs are not laid upon roots, but in certain Aphidinae dwelling upon stems in the proximity of roots, hibernating eggs are laid upon those parts of the plant (*Dentatus radicolu*, Mordv., upon the inferior portion of the stems of *Rumex* and *Rhæum*, in *Aphis plantaginis*, Schr., upon those of *Achillea millefolium*, and of other plants near the soil-surface). In general, autœcious (non-migrating) forms of plant-lice never could take their origin upon the roots of plants, and life upon the latter is a secondary phenomenon, connected only with migration. In other words, roots of plants could only serve as secondary hosts for plant-lice developed upon superterranean parts of woody plants independently from the fact whether primary hosts be older or younger than secondary ones. In the case of various *Eriosomea* from *Ulmus*, the latter plant is older than all those upon roots of which various *Eriosomea* are migrating: Gramineæ, Cyperaceæ, Pomoidæ (*Pyrus*, *Amelanchier*), Saxifragaceæ (*Ribes*). On the contrary, in the case of *Prociphilus* from *Fraginus* and *Lonicera* secondary hosts (*Abies* in the former, *Picea* in the latter case) are more ancient.

Migration to roots may be compared with that of *Siphonaphis mymphææ*, L., from *Prunus* and *Armeniaca* to superterranean parts of various aquatic plants like *Nymphæa*, *Hydrocharis*, *Sagittaria*, *Alisma*, *Butomus*, etc., for the eggs could not evidently have hibernated upon these secondary hosts.

Some contradictory cases can be explained in the following way: — When plant-lice performed their evolution upon some plants, secondary hosts, though belonging to very ancient groups, did not yet exist in the regions in question and came into touch with primary hosts when the evolution upon the

latter was already much advanced, and fundatrices were strongly differentiated. Thus, for example, the species of *Hormaphis* (subgenera *Hormaphis* and *Hamamelistes*) from *Hamamelis* (N. America, Japan, China) migrate to *Betula* where generations of emigrants develop upon the inferior side of the leaves. Hamamelidaceæ as well as Betulaceæ equally belong to most ancient types of vegetation. However, would *Hamamelis* happen to be more ancient than *Betula*, the question could be solved in the usual way; but in the given case we may admit that the genus *Hormaphis* accomplished its evolution first upon *Hamamelis* in subtropical regions where the birch-tree was then lacking, and that only later, *Hamamelis*, propagating northward, and *Betula*, penetrating southward, met at some point. In the same way perhaps could be explained the migration of *Astegopteryx* from *Styrax* (Styracaceæ are tropical plants of medium age) to *Quercus* (Fagaceæ are the most ancient plants of the moderate climate), of *Paraprociophilus tessellatus*, Fitch, from *Acer saccharinum* (more southern plant) to *Alnus* (more northern).

However, there are cases to which none of the above considerations could be applied. For example, *Phorodon humuli*, Schr., migrates from *Prunus* to *Humulus* (family Cannabiaceæ, to which *Humulus* is referred, belongs to Urticales, more ancient plants). *Aphis fabæ*, Scop., from *Eronimus* (Celastraceæ are plants of medium age), also migrates to *Chenopodium*, *Beta*, *Urtica* (Urticales are older plants), and *Papaver* (Papaveraceæ are older plants). Also *Aphis eronymi*, Fabr., from *Eronimus* migrates to plants many of which belong to more ancient ones (*Rumex crispus*, *Rheum*, *Atriplex*, *Capsella*). It is interesting that in some cases there are very closely related species performing the whole cycle of generations upon plants related with secondary hosts of migrating plant-lice. Thus, *Phorodon cannabæ*, Pass., accomplishes the full cycle of generations upon *Cannabis sativa* (of the same family as *Humulus*); *Aphis rumicis*, L. (species closely related with *A. eronymi* and *A. fabæ*), upon *Rumex obtusifolius* and *maritimus*; *Metopolophium graminæarum*, Mordv., upon Gramineæ. It seems in such cases that the plant-lice originally dwelt upon the most ancient herbaceous plants, then began to migrate to more recent ones (*Prunus*, *Eronimus*), and, finally, became polyphagous. The latter partly changed into migrating ones (from woody plants to herbaceous ones), partly continued their connection with herbaceous ones. In the above cases it would be to the advantage of a polyphagous species to change into a migrating one, because the polyphagy would unite the advantages of dwelling upon ligneous plants (good nutrition in

spring, good conditions of preserving the hibernating eggs) with those of life upon herbaceous plants (good nutrition in summer).

Still, the majority of heterœcious plant-lice migrate from more ancient vegetation types to more recent ones.

Migration or heterœcy means to any plant-lice the end of evolution of the cycle and the last stage in conquering new hosts. Strong differentiation of fundatrices is fastening a given species of plant-lice to given hosts. However appropriate would be plants among those appearing later, the species cannot pass to them with all generations, and, consequently, cannot begin upon them a new series of forms. More recent plants may become but secondary hosts to a given species of plant-lice, and with the time still other appropriate secondary hosts may appear. However, it does not appear to provoke any morphological modifications as long as the species remains related with one and the same primary host, and from the latter it cannot liberate itself. The appearance of the first secondary hosts means the end of evolution of the cycle, because should the cycle of generations not yet reach the end of its evolution, the species, including all its generations, could pass to a new plant (to superterranean parts of the latter), change upon it into a new species, and, in general, open a new series of forms. From this point of view, cycles of *Chermesidæ* were closed at least in the Mesozoic, for at that time their secondary hosts already existed. The evolution of the cycle of *Eriosoma lanigerum* ought to be performed before the appearance of Pomoideæ. Again, the evolution of the cycle might be long accomplished, secondary hosts, but suitable, did not appear, the species thus remaining autœcious. Thus, before the appearance of Compositæ, many a *Pemphigea* from *Populus* remained autœcious. But now all the *Pemphigea* from *Populus* are already heterœcious, only those remaining autœcious which cannot become heterœcious being represented by only one winged generation, namely *Pemphigus spirothecæ*, Pass. (remained but one winged generation, sexuparæ), the second winged generation having given way to wingless ones, within galls, and *Phlœmyzus passerinii*, Signoret (only one winged generation remained, the bisexual one). Almost all *Eriosomea* became heterœcious, and only *Eriosoma patchiæ*, Börner, still remains without appropriate secondary hosts. Many of Aphidiinæ differentiated upon Rosaceæ having passed to the latter from more ancient types of vegetation; some of them already went over to heterœcy, others remained autœcious either because the evolution of the cycle was not yet accomplished,

or because appropriate new hosts did not yet appear. Various Calliptera, very ancient to judge by their hosts (Salicaceæ, Betulaceæ, Fagaceæ, Ulmaceæ), were unable to become heterœcious even when new and suitable hosts appeared (*Acer*, *Tilia*, *Spiræa*, *Ononis*, *Caragana*, *Trifolium*, and others), their cycles having just begun their evolution (in some of them all generations of virgins are still winged; in others the fundatrices are very little modified). For such plant-lice there are large possibilities in future; they keep for a long time the possibility to pass to new plants with all their generations and to begin there new series of forms; their cycles must perform their evolution as far as very strongly modified fundatrices and can finally acquire the heterœcy.

At different epochs of the history of the earth the evolution of cycles in plant-lice proceeded and is still proceeding in one and the same way, and such a uniformity of the course of evolution may be explained only by the peculiarities of the climate in moderate latitudes with their seasons and periodical phenomena of vegetation. The fundatrices are adapted to spring conditions of vegetation, whereas the bisexual generation and fertilized eggs serve to withstand the unfavourable winter conditions. In fact, when plant-lice reach the Tropics with their constant even climate, their cycle becomes much simplified; the bisexual generation and fundatrices fall out, only wingless and winged virgins remaining. Heterœcy in Tropics is impossible, it can hardly stand even if it will be transported there from moderate latitudes. From the latter standpoint it would be very interesting to investigate the cycles of *Astegopteryx*, Karsch, which produce galls upon *Distylium* and *Styrax*.

LXXI.—*A new Species of Notocotylus [Trematoda], with some Remarks on the Genus.* By H. A. BAYLIS, M.A., D.Sc.

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A NUMBER of birds from Patagonia have recently been sent in the flesh to the Zoological Department of the British Museum. They were kept in cold storage on the voyage and after their arrival in London until required for skinning. After they had been skinned the writer had the opportunity of examining the bodies of several of these birds for internal

parasites, with the result that a considerable collection of parasitic worms, mostly still in very fair condition, was obtained.

One of the most interesting birds was a Sheathbill (*Chionis alba*), from the caeca of which a number of trematodes of two species were recovered. Both of these forms belong to the family Notocotylidæ. One of them is a *Paramonostomum*, and has been provisionally identified as *P. ionorne*, Travassos, 1921, a species previously recorded from several genera of wading birds in Brazil. The other is a species of *Notocotylus* which appears to be new, and of which it is proposed to give a description here.

Notocotylus chionis, sp. n.

The general shape of the body is elongate, with the lateral edges slightly incurved ventrally. The greatest width is in the posterior half. The length varies between 4 and 5.5 mm., the maximum width between 0.95 and 1.3 mm. The ventral glands are in three longitudinal rows, each row containing 19-21 glands. The posterior three glands of each lateral row are relatively very large. In the median row the posterior gland is very small, the third and fourth from the posterior end being the largest.

The oral sucker has a diameter of 0.22-0.29 mm. The intestinal branches have the usual arrangement, passing between the testes and the ovary at their hinder ends. The genital pore is very close to the oral sucker, being apparently situated at about the same level as the intestinal bifurcation. The cirrus-sac extends almost to the middle of the body. Its posterior portion is fusiform, its anterior portion narrow and cylindrical. It measures 1.7-2.6 mm. in length and 0.13-0.2 mm. in greatest diameter. The testes are deeply lobed on their outer edges, and may, in fact, almost be described as branched. They extend nearly to the posterior extremity of the body, and measure, in large specimens, up to 0.85 mm. in length.

The vagina is about two-thirds as long as the cirrus-sac. The uterus forms 16-20 transverse loops on each side. These sometimes extend slightly beyond the intestinal branches. The vitelline glands extend from the testes slightly beyond the middle of the body. There are about 4-6 loops of the uterus in front of them. The ovary is slightly lobed, and is not much more than one-third of the size of the testes. The shell-gland lies immediately behind it. The average length of the eggs (measured without their polar filaments) is about 0.02 mm.

DISCUSSION.

The species of *Notocotylus* parasitic in birds are by no means easily distinguished. Fuhrmann (1919, p. 359) has

Fig. 1.

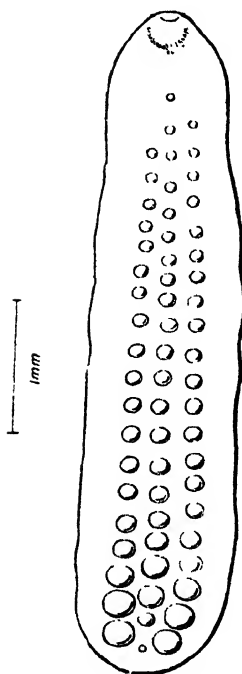


Fig. 2.

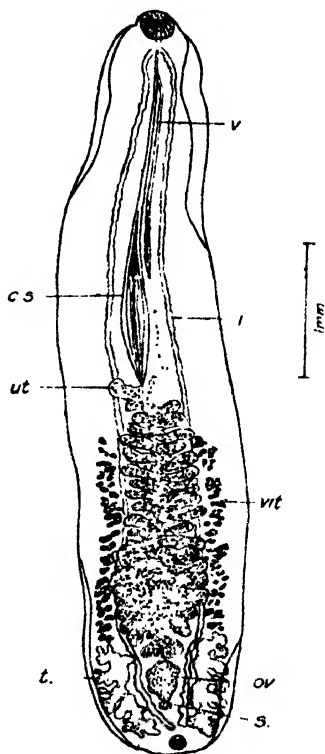
*Notocotylus chionis*, sp. n.

Fig. 1.—Ventral aspect, viewed as an opaque object, showing the ventral glands.

Fig. 2.—Ventral view of a stained and mounted specimen.

c.s., cirrus-sac; i., branch of intestine; ov., ovary; s., shell-gland;
t., testis; ut., uterus; v., vagina; vit., vitellaria.

given a comparative table including four of them—*N. attenuatus* (Rud.), *N. aegyptiacus*, Odhner, *N. gibbus* (Möhlis), Kossack, and *N. seineti*, Fuhrmann. To these must be added

N. urbanensis, Cort, 1914, and *N. diserialis*, Ssinitzin, 1896, the latter a very little known species. Apart from absolute and relative measurements (which should be treated with reserve in such soft-bodied and contractile animals) almost the only character that can be regarded as specific is the number of glands in the three ventral rows which are usual in the genus. But even this character does not appear to be very constant within the species. *N. attenuatus* is said to have 16-17 glands in the median row and 14-15 in the lateral rows. In *N. ægyptiacus* the number in all the rows is said to vary between 12 and 14, and in *N. gibbus* between 6 and 8. The writer has seen specimens from a moorhen (*Gallinula chloropus*), in most respects agreeing fairly well with Kossack's description of *N. gibbus**, but having apparently ten glands in each row. It is possible, in fact, to arrange the figures in ascending order in a way which seems to indicate that the number of glands per row increases in direct proportion to the length of the specimens, thus:—

Species.	<i>gibbus</i> .	<i>æneti</i> .	<i>ægyptiacus</i> .	<i>urbanensis</i> .	<i>attenuatus</i> .
Length in mm.	1.44-1.65	2	3.5	2.5-3.5	Up to 5
Number of glands in median row.....	6-8	12	12-14	13-14	16-17
Number of glands in each lateral row.....	6-8	12	12-14	13-14	14-15

Such a comparison of the existing descriptions, it will be seen, especially if possible differences in the age and maturity of the specimens be taken into account, suggests the possibility that the number of species ought to be reduced. On the other hand, the form here described has a larger number of ventral glands than any of the other supposed species, and in the present state of our knowledge of the genus it seems necessary to regard it as a new species.

The type-specimens are in the British Museum (Natural History).

REFERENCE.

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* These have been recorded erroneously as *Catatropis verrucosa* (Fröl.) in a list of parasites from British Vertebrates (Ann. & Mag. Nat. Hist. (10) i. p. 331 (1928)).

LXXII.—*Papers on Oriental Carabidæ*.—XXI.

By H. E. ANDREWES.

A FEW further notes on synonymy, etc., are put on record here, an asterisk being used, wherever necessary, to indicate the name which is to stand. These notes are partly the result of assistance received from two quarters. I am much indebted both to Dr. R. Gestro and to Mr. H. C. Blöte—to the former for sending me a number of type-specimens from the Genoa Civic Museum, and to the latter for comparing specimens which I sent to him with various types in the Leiden Museum and also for the loan of several specimens previously compared with the types.

Scarites boysi, Chaud. Bull. Mosc. 1855, i. p. 57 = *S. guineensis*, Dej.* Spec. Gen. v. 1831, p. 484.

I have in my collection an example compared with *boysi*, also a Senegalese example of *guineensis*, the label on which appears to be in Chaudoir's handwriting, and I am unable, on placing the two specimens side by side, to discover any material differences. This species appears to be one of a probably small number in this family, among which may also be mentioned *Calosoma olivieri*, Dej., and *C. imbricatum*, Klug, which range from Western or North-western Africa across the sandy wastes of Northern Africa, Arabia, and Baluchistan as far at least as the desert-region of Sind, and sometimes even farther.

Haplogaster humeralis, Putz. in Chaudoir's Mon. des Scaritides—I., Ann. Soc. Ent. Belg. 1879, p. 151.

I saw at Rennes some years ago one of the two specimens which Putzeys described under this name, and formed the opinion that the species could not properly be placed under the genus *Haplogaster*. My notes are, unfortunately, scanty, but these and the long description lead me to think that it belongs to the genus *Gnaphon*, in which I am placing it.

Scapterus figuloides, Gestro, Ann. Mus. Civ. Gen. xviii. 1882, p. 301, fig. = *S. sulcatus*, Putz.*, Postscr. ad Oliv. Mon., Mém. Liège, xviii. 1863, p. 16, t. i. figs. 16–18.

Dr. Gestro's type is a much worn specimen from the "Indes Orientales," without any exact locality-label, and I

am unable to find any characters to separate it from Putzeys's N.E.-Indian species.

Chlœnius pachysomus, Chaud., Mon. des Chlœniens, Ann. Mus. Civ. Gen. viii. 1876, p. 117 = *C. rugulosus*, Nietn.* Journ. As. Soc. Beng. 1856, v. p. 388.

The type-specimen, which is in the Genoa Museum, is unique. Chaudoir did not know Nietner's species, and in his Monograph (p. 90) gives a rough translation of the original description. In the key he placed the two species in quite different sections, or the synonymy would no doubt have been discovered earlier.

Anoplogenius patinalis, Bates, Ann. Mus. Civ. Gen. xxxii. 1892, p. 346; Andr. Ann. & Mag. Nat. Hist. (9) iii. 1919, p. 474.

In 1919, on the information then available, I put forward the synonymy *Anoplogenius patinalis*, Bates = *Lepithrix foliolosus*, Nietn. = *A. discophorus*, Chaud. The examination of typical specimens has since proved Nietner's species to be identical with Chaudoir's, but, thanks to Dr. Gestro, I have now been able to examine Bates's type also, and his species must, I think, although nearly allied, be considered distinct. In size and form the two species are remarkably alike, but the wide yellow margin of both prothorax and elytra in *discophorus* is in *patinalis* reduced to a very narrow one, and in the latter the prothorax is not only evidently longer but has all the angles a little less rounded. In so far, therefore, as this species is concerned the above indication of synonymy must be withdrawn.

Perigona luzonica, Putz. Ann. Mus. Civ. Gen. vii. 1875, p. 728 = *P. ruficollis*, Motsch.* Bull. Mosc. 1851, ii. p. 506.

In a paper published in 1873 Putzeys redescribed Motschulsky's species, but presumably no longer had an example before him two years later, when the Philippine species was described, or he could hardly have failed to compare it with *ruficollis* instead of *nigrifrons*. I have recently compared two examples, previously compared with the respective types, and, although there are variations in colour, especially that of the prothorax, and in the width of the red sutural stripe on the elytra, I cannot see any reason for separating the species.

Perigona plagiata, Putz. Ann. Mus. Civ. Gen. vii. 1875, p. 734.

In 1907 Fauvel substituted the new name of *P. annamita* for *ruficollis*, Bates (not Motch.), and in 1927 I identified this species with *P. discipennis*, Bates. On a further examination of my material I can see no reason why the above should not all be included under *P. plagiata*, of which I have an example compared with the type. It is true that there are differences both in size and colour, but this frequently happens in the case of species with a large area of distribution, when examples are compared from widely separated localities, and is particularly noticeable in the case of the cosmopolitan *P. nigriceps*, Dej. The synonymy will therefore be:—

Perigona plagiata, Putz.*.

Perigona ruficollis, Bates (not Motch.), Ann. & Mag. Nat. Hist. (5) xvii. 1886, p. 149; id. Ann. Mus. Civ. Gen. xxvii. 1889, p. 104; id. op. cit. xxxii. 1892, p. 378.

Perigona ruficollis, var. *nana*, Bates, Ann. Soc. Ent. Fr. 1889, p. 273.

Perigona discipennis, Bates, Trans. Ent. Soc. Lond. 1883, p. 265.

Perigona annamita, Fvl. Rev. d'Ent. 1907, p. 104.

The distinctions drawn between *plagiata*, Putz., and *ruficollis*, Motch., are not altogether convincing, as they depend so largely upon the elements of size and colour. A revision of the genus would probably produce further instances of synonymy, but the material for this is not at present available.

Casnonia subapicalis, Oberth. Notes Leyd. Mus. v. 1883, p. 216 = *Odacantha distigma*, Chaud.*, Bull. Mosc. 1850, i. p. 26 (*O. bimaculata*, Schm., Goeb.).

For this identification I am indebted to Mr. H. C. Blöte, who kindly compared an example of *distigma* which I sent to him with the type of Mr. Oberthür's species.

Carabus sexpustulatus, F., Syst. Ent. 1775, p. 825; id. Spec. Ins. i. 1781, p. 307; id. Ent. Syst. i. 1792, p. 145. "Dom. Edler."

In the original description the locality is given as "Ind. Or.," but in 1781 this has been changed in favour of South America; in 1792 "Ind. Or." reappears, but in Syst. Eleuth. i. 1801 the name has disappeared. This would lead to the inference that the species had been transferred to another

genus, or even family, but, as I have failed to trace it, I am for the present including it in the genus *Brachinus*, to which, judging by the description, it appears to belong. I cannot learn that there was ever an "Edler" collection, and enquiries made in various directions regarding the type have hitherto proved unsuccessful.

Brachinus clarescens, Bates, Ann. Mus. Civ. Gen. xxxii. 1892, p. 395 = *B. limbellus*, Chaud.*, Mon. des Brachynides, Ann. Soc. Ent. Belg. 1876, p. 70.

I have a specimen compared with Chaudoir's type, and that of Bates, now in the Genoa Civic Museum, agrees with it on the whole very well.

Brachinus stenoderus, Andr. (not Bates) in Mission Babault Ind. Carab. 1924, p. 57 = *B. pallidipes*, Reitt.* Ent. Blätt. 1919, p. 137.

The type of Reitter's species is in the collection of Dr. A. Fleischer, who kindly compared with it and returned to me another Kashmir example which I sent to him for the purpose. The two species are exceedingly closely allied, but in the Kashmir form the intervals of the elytra are hardly more than costate, while in the Japanese form they are carinate, and this, with one or two other slight differences, seems to justify the retention of *pallidipes* as distinct.

Brachinus hageni, Oberth. Notes Leyd. Mus. v. 1883, p. 217 = *B. bigutticeps*, Chaud., Mon. des Brachynides, Ann. Soc. Ent. Belg. 1876, p. 52.

I have a specimen compared with Chaudoir's type, and a second similar though rather smaller specimen has been compared by Mr. Blöte with the type of *B. hageni*. Chaudoir did not know the provenance of his specimen; he writes:—"La patrie de cet insecte m'est inconnue, mais je présume qu'il est originaire de la presqu'île transgangétique, ou des îles de la Sonde." My own examples were found in Borneo, so that the second conjecture is no doubt the right one.

Cymindis alticola, Andr. (not Casey), Ent. Month. Mag. 1926, pp. 70 & 79 = *C. championi**, nom. nov.

Mr. M. Liebke was good enough a few months ago to

draw my attention to the fact that the name *C. alticola* was preoccupied, and I therefore substitute a new one.

Calleida cupreomicans, Oberth. Notes Leyd. Mus. v. 1883, p. 218.

Mr. Blöte kindly sent me an example of this species for examination. With its wide prothorax, broadly explanate at the sides, and with the median part of the base produced behind, this insect conforms to Lacordaire's *Lebia*-type rather than to his *Cymindis*-type. The apical joint of the labial palpi is dilated, setulose, truncate, and somewhat compressed at apex, the elytra moderately truncated behind, the fourth joint of the tarsi strongly bilobed, and the claws pectinate. These characters taken together point to *Physodera*, to which genus, although the insect does not bear a very close resemblance to any of the other species, I refer it for the present.

LXXIII.—Note on *Sciurus splendidus*, Gray.

By OLDFIELD THOMAS.

IN 1842* Dr. Gray described a squirrel of unknown locality as *Sciurus splendidus*, a name which has been assigned to different species from various parts of the world, but has never been satisfactorily identified. In 1908† Mr. Wroughton, after examining the type, stated that it was not a member of the Asiatic *finlaysoni* group, but did not say what it was, and I have now thought it desirable to correct this omission.

By the kindness of Dr. J. J. Simpson, of the Liverpool Free Public Museum, I have had the loan of the type, which is there preserved, and I find it can be absolutely matched in every detail by a squirrel called by Dr. Allen‡ *Sciurus saltuensis magdalense*, a native of the Santa Marta region of Colombia. The name *splendidus* will therefore disappear from the Asiatic list, while it will supplant *magdalense* for the American species, with *saltuensis* and *bondæ* as other subspecies.

A specimen in the British Museum from the Rio Cesar, Santa Marta (no. 13. 7. 13. 1) agrees particularly well with the Liverpool *splendidus*, and may be accepted as perfectly representative of it.

* Ann. & Mag. Nat. Hist. (1) x. p. 263.

† Loc. cit. (8) ii. p. 394.

‡ Bull. Am. Mus. N. H. xxxiii. p. 593 (1914).

LXXIV.—Two more new Species of Diopsidæ (*Diptera*).

By E. BRUNETTI*.

Diasemopsis exquisita, sp. n.

♀.—Sierra Leone; Fernando Po. Long. 4 mm.

Head pale yellowish, sometimes almost white, sometimes brownish yellow; transverse black line narrow, slightly curved, joining bases of eye-stalks; ocellar spot minute, black. Eye-stalks distinctly short and stout, about as long as from neck to tip of scutellum; space between tips of eyes distinctly greater than full length of abdomen. Vertical bristle before middle of eye-stalk; a distinct apical bristle. Eye-stalks blackish brown, contrasting (except at base) with the yellowish head. Eyes dark brown. Lower part of face rounded, no facial teeth.

Thorax: neck more or less yellowish; dorsum moderately dark brownish grey, scutellum similarly coloured or nearly black; spines brownish yellow, moderately long, slightly curved, apical bristle long; postalar bristle long; sternopleuræ shining black.

Abdomen: first segment black, somewhat brownish at base, with broad band of blue-grey dust on distal third or half; second segment with a basal band, narrowed at sides, and a more or less distinct fair-sized pale spot, sometimes reddish-tinged, at each hind corner; third segment velvet-black, with a broad blue-grey or pinkish hind marginal band, sometimes having a narrow V-shaped indentation on its front margin, or in certain individuals extended forwards in a long, narrow, median triangle; fourth segment yellowish brown, with a pale pinkish or almost whitish fair-sized spot on each front corner; remainder of dorsum shining black; venter yellowish, blackish at base and about middle and on sides of third segment, but markings inconstant.

Legs: coxæ black; fore femora brownish yellow, basally more or less blackish, considerably incrassate, with several distinct bristles on underside towards tip, and often a small black spot near tip on outer side; remainder of legs yellowish; posterior femora with ill-defined blackish rings on second and

* The following descriptions, forming a supplement to those relating to the same family recently printed (*Ann. & Mag. Nat. Hist.* ser. 10, vol. ii. pp. 275–285, September 1928), were likewise found after his death among the late Mr. Brunetti's unpublished papers.—E. E. AUSTEN.

last fourths; hind tibiæ indefinitely darker basally and apically.

Wings nearly clear; a weak but quite obvious pale brownish band across middle, wide enough at its widest part to include both cross-veins, much narrowed in front (in marginal cell), and ending over posterior cross-vein on hind margin of wing; tip of wing narrowly infuscated. *Halteres* yellowish.

Type from Sierra Leone, Malumba, 8. ix. 1924 (*E. Hargreaves*), in British Museum, presented by the Imperial Bureau of Entomology; five paratypes from Fernando Po, 1901 (*L. Conradt*), in the Paris Museum; and one paratype (minus abdomen) from Belgian Congo, Kai-Bumba, 10. x. 1920 (*Dr. H. Schouteden*), in the Belgian Congo Museum.

An exceptionally pretty little species, which appears to resemble *D. pulchella*, Eggers.

Teleopsis latifascia, sp. n.

♂.—Sierra Leone. Long. 5–6 mm.

Head entirely black, vertex broad, with a small space in middle more flattened, depressed and rather shining; a longitudinal groove just beyond each side of this space; vertical bristle normal. Eye-stalks stout, ending in a long strong spine on upper side, about as long as from neck to tip of scutellum. Antennæ black, arista long. Face large, approximately square, but just a little narrower below, slightly convex, not at all projecting in profile. Facial teeth very strong; mouth-parts blackish.

Thorax nearly black, a shade of brownish about dorsum and scutellum. Pleural spines unusually long and strong; dorsal (supra-alar) spines normal; scutellar spines long and strong, nearly straight, no apical bristle.

Abdomen black, strongly clavate; first segment parallel-sided, abdomen thence widening to three times basal width; whitish lateral spot at base of second segment (apparently with a tendency to overlap hind margin of first), and a similar lateral one including hind corners of second segment and basal corners of third.

Legs entirely black, apparently almost bare; fore femora distinctly incrassate (in case of type and paratype too tightly closed for examination of teeth to be possible); some brownish-yellow pubescence below hind tarsi.

Wings pale grey; a small dark brown streak from tip of anal cell to hind margin; a broad brown median transverse

band, wide enough to include both cross-veins, narrowed on costa but reaching hind margin of wing in its full width; an apical moderately wide band extending from in front of second to beyond fourth vein. *Halteres* whitish.

Type and paratype from Sierra Leone, Yama, 26. xi. 1924 (*E. Hargreaves*), in British Museum, presented by the Imperial Bureau of Entomology.

This species is readily recognizable owing to its stoutly built, wholly black body and well-marked wings.

LXXV.—*A new British Species of Collembola.*

By H. WOMERSLEY, F.E.S.

Hypogastrura pseudo-purpurascens, sp. n.

Brownish, mottled, with slight tendency to bluish. Eyes, eight on each side on a dark patch. Post-antennal organ with four tubercles arranged around a central one much as in *purpurascens*, Lubbk. Antennæ shorter than the head, without eversible sac between the third and fourth joints, relative lengths of joints 4:5:6:7. Six or seven olfactory hairs on fourth joint as well as a terminal knob. Sensory organ on third joint as in fig. 3. Unguis moderately long and strong, with a prominent inner tooth rather more than one-third from tip. Unguiculus barely reaching the tooth of unguis, with a broad inner lamella for half its length. Tibio-tarsal tenent-hairs 3:3:3, strongly clavate, the two outer ones being placed rather more than twice the distance from tip of tibio-tarsus than the medial one is (fig. 1). (In *purpurascens* they are all at about the same distance.) The medial tenent-hair only reaches the tip of unguis. Furca much as in *purpurascens*, relative lengths of manubrium, dentes, and mucro 7:7:3, mucro two-thirds the length of hind unguis, tenaculum with three barbs. Anal spines two, minute, slightly curved, not more than one-quarter the length of hind unguis and placed on rather longer papillæ. Clothing consisting of two rather irregular rows of fairly long recurved setæ, with laterally a longer straighter seta. The setæ are somewhat more numerous apically.

Length 1.7 mm.

Type-slide of two specimens taken under loose bark of an old stump at Flax Bourton, Somerset, 12. viii. 28.

This species has probably been passed over by other students of the Collembola as well as myself as a mere colour-form of the common *H. purpurascens*. It is, however,

Fig. 1.

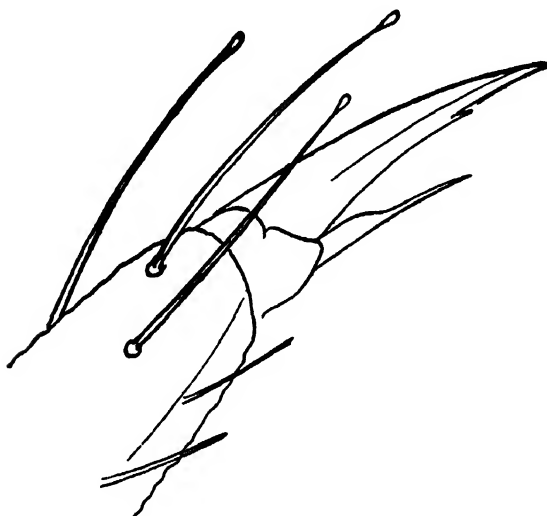


Fig. 2.

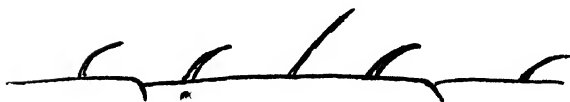


Fig. 3.



Fig. 4.

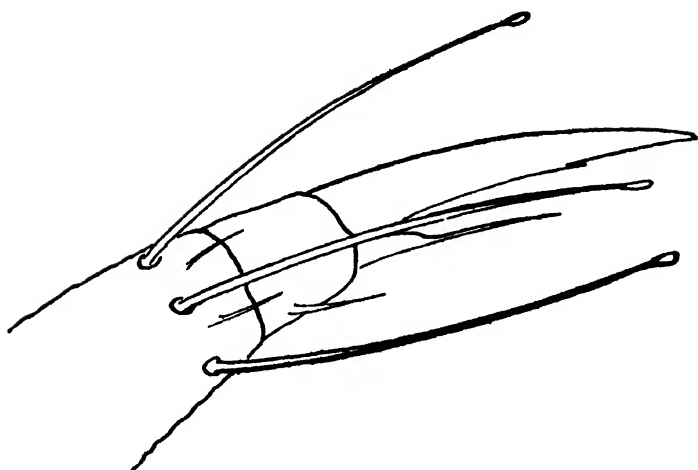


Fig. 1.—Hind foot of *Hypogastrura pseudo-purpurascens*, sp. n.

Fig. 2.—Abdominal setæ of ditto.

Fig. 3.—Sensory organ on third antennal joint of ditto.

Fig. 4.—Hind foot of typical *Hypogastrura purpurascens*, Lbk.

markedly distinct in the disposition of the tibio-tarsal tenent-hairs, as well as the clothing and other lesser important details. Its habitat, further, judging from my captures, would appear to be restricted to under the loose bark of old stumps, and not damp walls such as are usually inhabited by *purpurascens*.

It is also somewhat closely related to *tullbergii*, Schaffr., and *humi*, Fölm. A re-examination of my older specimens gives the following records for the species herein diagnosed:—

Blaise Castle, Bristol, 24. ii. 23.

Leigh Woods, Somerset, 21. xi. 23.

West Town, Somerset, 2. i. 26.

Var. *trispina*, nov.

Among my specimens from Leigh Woods as above was one that I have recorded as var. *trispina* of *purpurascens*. This, like the typical forms, is in reality the new species.

LXXVI.—Mutillidæ from Siam.

By T. D. A. COCKERELL, University of Colorado.

THE family Mutillidæ of the Hymenoptera includes an enormous number of species, parasitic when young in the nests of other insects, mostly bees and wasps. The females are wingless, and so unlike the males that it is very difficult to match the sexes without biological observations. Consequently the sexes have usually been described as different species, and ultimately the number of valid names will prove smaller than our present lists would sometimes indicate. Thus the 75 ostensible species recorded from Ceylon, where the sexes are associated, may well be cut down to 50 or less, though the discovery of new species will perhaps make up for the losses. From Barrackpore, in Bengal, 43 species have been reported, this being the richest locality in India, so far as known. From Poona come 16, Decsa 14, Khasia Hills 20. About fifteen other localities in India are represented by one or more records, but, in spite of the work done, many regions are quite unexplored for these insects. The females being apterous, the Mutillidæ do not spread as easily as other insects, and most of the species have a rather limited distribution. Some species are recorded as having an extremely wide range, but there is probably confusion in some cases, and a critical examination of the data is desirable. The recently published work of Mickel, resulting from the examination of about 10,000 specimens of the American genus *Dasymutilla*, is illustrated by a number of maps showing distribution. Some of the species have a wide range, but are by no means universally distributed. On the whole, the maps are very similar to those which might be made for species of mammals. In Asia no such maps can be constructed at the present time, but it is possible to compare certain faunæ which have been more or less intensively studied. From Burma, mainly owing to the zealous collecting of Leonardo Fea, we know 40 Mutillidæ, the great majority distinct from those of India proper. I include in this enumeration a few from Tenasserim. About 10 species are recorded from the Malay Peninsula (which in reality is probably as rich as Ceylon), and from French Indo-China we know apparently only *Odontomutilla urania*, Smith, *Mutilla griseomaculata*, André, and *M. oculata*, Fabricius. From Siam I find only one record—*M. oculata*,—though *O. urania*

is said to exist in the Laos country, on the border between French and Siamese territory. The Mutillidæ of China are very inadequately known, though Zavattari has described many species from Formosa. When recently in Siam I obtained three species of Mutillidæ in the Nan region, in the northern part of the country.

Mutilla sohmi, sp. n.

♀.—Length about 10 mm.

Robust, shining; head, thorax, and legs chestnut-red; abdomen black, with the very broad polished hind margins of the segments red; venter dark reddish; whole insect with very long erect coppery-red hair, not hiding surface, and present on thoracic dorsum only in front, at sides, and behind, on abdomen forming bands at the end of the black portions; head globose, very convex, a little wider than thorax, with scattered distinct punctures; mandibles thick, simple, not excised beneath, black at end (the character of the mandibles throws it out of *Mutilla* as restricted by Ashmead, but not by André); eyes convex, slightly oval, well faceted, near base of mandibles; face very short and retracted; antennæ very short; scape large and stout, curved apically; flagellum short and thick; fourth antennal joint expanded apically, a little longer than third; thorax seen from above quadrate, broader than long, polished, with very large rather close punctures, tending to run in longitudinal lines; anterior margins of thorax rounded, no teeth on posterior margin. Legs rather short, with thin long red hair. Abdomen with scattered distinct punctures; first segment broadly sessile on second, vertically descending anteriorly, the basin margined; pygidium distinctly defined, the apex bidentate.

Siam; near Mecatin, Feb. 2. Collected by Sohm, the chief of my native assistants, in the jungle.

A most extraordinary species, unlike any I find described.

Mutilla mackiew, sp. n.

♂ (type).—Length about 9 mm., anterior wing 8·7 mm.

Head, thorax, legs, antennæ, and tegulæ black; abdomen with the first five segments bright chestnut-red, the apex black; head obtusely triangular seen from in front; eyes large and prominent, deeply emarginate; clypeal region concave, smooth and polished, presenting an abrupt transverse margin; mandibles with a small inner tooth and a large

obtuse outstanding one on the inferior margin some distance from apex; antennæ slender, third joint about as long as fourth; cheeks, sides of face, and base of mandibles with silvery-white hair; front and very broad upper margin of prothorax with pale golden hair; disc of mesothorax and scutellum with thin black hair; upper surface of metathorax densely covered with shining yellowish-white hair; mesopleura with silvery-white hair; mesothorax bare, contrasting with the densely tomentose prothorax, extremely densely and strongly punctured; scutellum with a stout erect median spine. Wings fuliginous, shining violaceous, the base hyaline; marginal cell short and broad; second cubital long, pointed basad, receiving recurrent nervure about middle; third cubital very large, hexagonal, pointed in middle of apex, with an appendicular nervure; basal nervure going basad of nervulus. Legs long, with thin pale hair; spurs white. Abdomen shining, sparsely punctured (especially in middle of segments); first segment swollen apically, its ventral keel long, sharply truncate at either end (in lateral profile), the margin gently concave; segments 3 to 5 with rather distinct broad bands of pale golden hair.

♀.—Length about 7.5 mm.

Head, legs, and abdomen black, thorax bright ferruginous; head rather small, about as wide as thorax; small spots above base of antennæ, and middle of mandibles, ferruginous; mandibles without the inferior tooth; third antennal joint much longer than fourth; vertex with appressed copper-red hairs, visible only in certain lights; thorax above with very thin pale hair; seen from above the thorax is parallel-sided, considerably longer than broad; prothorax sharply margined anteriorly at sides; corners of metathorax without denticles, except one minute rudiment of one; thorax above dull and rugose. Legs with pale hair. Abdomen with suture between first and second segments depressed, marked by a shining band; second segment dull black, with a pair of very large nearly circular spots of golden pubescence, the interval between them equal to about half the diameter of a spot; second and third segments entirely covered with the same pale golden tomentum; fourth segment with some dark hair, apex with pale; subapical region finely longitudinally striate. The eyes are large, broad-oval, not emarginate.

Siam; Csjun, on the Nan River, Jan. 28; the sexes taken together by Miss Alice Mackie.

The male is close to *M. pilosella*, Magr., from Upper Burma, but is easily distinguished by the thoracic pubescence.

It also resembles *M. oculata*, Fabr., as figured by Bingham (1905), but the keel on first ventral segment of abdomen is quite different.

Another female of *M. mackieæ* was taken by Miss Mackie at Nan, Jan. 13. It is a trifle larger, without distinct red spots at base of antennæ, red hair on vertex nearly lacking; spots on second abdominal segment smaller, the distance between them nearly equal to the width of a spot. It appears not to be a distinct species.

Mutilla meeungensis, sp. n.

♀.—Length about 10 mm.

Rather slender, head and abdomen black, legs and thorax bright ferruginous, but knees, tibiæ at extreme apex, and tarsi black; mandibles red in middle; scape and two following joints red, rest of antennæ black. Head thick, a little wider than thorax, very densely and coarsely rugoso-punctate; mandibles with a small inner tooth; antennæ almost contiguous at base, scape curved; third joint expanded apically, short, but considerably longer than fourth; flagellum rather short and stout (conspicuously stouter than in *M. mackieæ*); head with scanty pale golden hair, dense on lower part of cheeks; thorax very densely rugoso-punctate, but glistening, parallel-sided seen from above, about one and a half times as long as broad, a small angular projection on each side anteriorly, and small denticles posteriorly. Legs with pale golden hair, copper-red at ends of tarsal joints. First abdominal segment small, broadly sessile on second, rufous beneath; second segment intense black, with thin erect black hair; a pair of large, broad, oval, clear-cut spots some distance from base, and nearly the width of a spot apart, these spots consisting of pale golden hair, while the segment has a narrow apical band of the same, slightly interrupted in middle; third segment with a very broad band of golden tomentum, having a linear median interruption; fourth and fifth black, a large tuft of golden hair at each side of sixth; pygidial area smooth and polished, wide, with a distinct margin; venter with thin golden hair-bands; second ventral segment very strongly punctured, slightly reddish in middle apically.

Siam; Pah Meeung Mountain, Jan. 18 (*Cockerell*).

The following table will be useful for the separation of a number of similar females:—

Apical margin of second abdominal segment	
with a band	1.

- Apical margin of second segment without a band 4.
1. Marks on abdomen golden or golden ferruginous 2.
- Marks on abdomen greyish or silvery 3.
2. Thorax almost square; abdomen 4-spotted. *hilliputiana*, André.
- Thorax elongate; abdomen with two spots and two bands *meeuensis*, Ckll.
3. Metanotum with conspicuous denticles or spines at sides posteriorly; band on third segment broken into two quadrate marks. *pauli*, André.
- Metanotum not thus armed; third segment with a hair-band *griseomaculata*, André.
4. Head covered with golden hair; thorax, seen from above, square *pulchriceps*, Cam.
- Head not covered with golden hair; if some red hair, thorax not square 5.
5. Third abdominal segment with silvery-white hair, no band on fourth *auronotata*, André.
- Second and third segments covered with golden hair 6.
6. Thorax square. (Ceylon.) *soror*, Sauss.
- Thorax elongate. (Siam.) *mackieæ*, Ckll.

M. meeungensis differs from *M. oculata*, Fab., in a number of points. Thus *M. oculata* is described as having the antennæ black, the abdominal markings grey, and the segments beyond the second with subinterrupted grey marginal bands. Fabricius stated that *M. oculata* was from China.

LXXVII.—*Descriptions of Two new Cyprinodont Fishes from Nigeria.* By ERNST AHL, Zoological Museum, Berlin.

MR. J. R. NORMAN, of the British Museum (Natural History), has recently sent me specimens of two species of Cyprinodont fishes from the Kiyawa River, Nigeria, for determination, which prove to be new to science. These form part of a large collection kindly presented to the Museum by Mr. Lt. Lloyd. I am much indebted to Mr. Norman for giving me the opportunity of examining and describing these specimens, as they will be of great assistance to me in my forthcoming monograph of the African Cyprinodontidæ.

Aplocheilichthys normani, sp. n.

Depth of body 4, length of head $3\frac{1}{4}$ to $3\frac{3}{8}$ times in total length. Head flat above; snout short and broad, much

shorter than eye; mouth directed upwards, lower jaw projecting; teeth in bands in both jaws, those of the outer series much enlarged and widely separated from one another; eye $2\frac{1}{2}$ times in length of head, a little longer than postorbital part of head, only a little less than interorbital width; præorbital nearly $\frac{1}{2}$ diameter of eye. Dorsal 5-6, originating twice as far from end of snout as from root of caudal, above posterior third of anal; longest rays about $\frac{3}{4}$ length of head. Anal 9-11; longest rays about $\frac{3}{4}$ length of head. Pectoral $\frac{3}{4}$ length of head, extending a little beyond base of pelvic; latter moderately large, pointed, the anterior ray produced, extending beyond origin of anal, much nearer end of snout than root of caudal. Caudal rounded, as long as head. Caudal peduncle $1\frac{1}{2}$ times as long as deep. 25-26 scales in a longitudinal series (+1 or 2 on base of caudal), 16 round bony in front of pelvics. Pale yellowish brown, each scale edged with darker; a fine bluish-black line runs along the side of the body; all the fins greyish.

Total length 26 mm.

Kiyawa River (near Katagum), Northern Provinces, Nigeria.

Described from two specimens, 21 mm. and 26 mm. in total length. This species is near *Aplocheilichthys johnstoni* (Günther).

Nothobranchius kiyawensis, sp. n.

Depth of body $3\frac{1}{2}$ (σ) to $4\frac{1}{4}$ (φ), length of head $3\frac{1}{4}$ times in total length. Upper surface of head from the interorbital region to the occiput convex; snout short and broad, a little shorter than eye; mouth directed upwards, lower jaw projecting; teeth in broad bands, the outer series consisting of a few enlarged, conical, curved teeth, those of the upper jaw nearly horizontal; inner series of teeth not distinctly enlarged; eye $3\frac{1}{2}$ to $3\frac{3}{4}$ times in length of head, $1\frac{1}{2}$ times in interorbital width; space between eye and lip very narrow, the latter forming an angle fitting into a notch close to the former. Dorsal 13-15, originating nearer to root of caudal than to occiput, about twice as far from end of snout as from root of caudal; longest rays about $\frac{1}{2}$ length of head. Anal 14-15, origin a little behind that of dorsal. Pectoral shovel-shaped, about $\frac{2}{3}$ to $\frac{1}{2}$ length of head, not reaching base of pelvic; latter much nearer root of caudal than end of snout, just reaching origin of anal. Caudal rounded (φ) or obliquely truncate (the upper lobe a little longer) (σ), $\frac{3}{4}$ length of head.

Caudal peduncle as long as deep. 26 scales in a longitudinal series, 24 round body in front of pelvics; caudal scaly at base. Male greyish brown on upper surface, bluish white on sides and lower surface; sides of body with a number of large, rounded, irregularly arranged carmine-red spots; about three oblique red streaks behind the eye on upper part of opercular region, and some red spots below them; a horizontal red streak below the eye; gill-membranes distinctly red. Base of dorsal fin bluish with large red spots, above this a red line followed by a broad white area and a red margin; anal with a carmine-red band near the base, a broad white area, and a reddish-brown margin; caudal dark grey in the middle, the upper and lower edges with a broad white streak, the upper bordered by a narrow dark line; pectoral greyish, the lower margin a little darker; pelvics reddish. Female greyish without any markings; darker above, whitish below; all the fins greyish.

Total length 40 mm.

Kiyawa River (near Katagum), Northern Provinces, Nigeria.

Described from two specimens, a male 49 mm. and a female 40 mm. in total length. The species is near *Nothobranchius rachovii*, E. Ahl, from Beira.

BIBLIOGRAPHICAL NOTICE.

Bulletin of the Raffles Museum, Singapore, Straits Settlements.
No. 1, September 1928. 44 pp., 2 pls. Price 60 cents or 1s. 6d.

HITHERTO the Raffles Museum has had no publication of its own, and the results of the work of the Museum staff and other specialists have had to be published in various other periodicals. The energetic activities of the present Director of the Museum, Mr. C. Boden Kloss, and of his staff, have resulted in an increased output of scientific papers based on the Museum material, and the problem of publishing them without undue delay could only be solved by starting the present 'Bulletin.' The 'Bulletin' will be published as material is available; each number will be complete in itself and will have its own pagination, but it is intended whenever sufficient numbers to form a volume of reasonable size have been produced to issue a titlepage, table of contents, and index.

It is very appropriate that the first paper in the new journal

should be by Dr. R. Hanitsch, who was the Director of the Raffles Museum from 1894 to 1919, and whose numerous works on Malayan Blattidæ must be regarded as a solid foundation to our still very limited knowledge of the Malayan insect fauna. The paper by Dr. Hanitsch published in the 'Bulletin' occupies the whole of the first number (apart from a short prefatory note by Mr. Boden Kloss), and deals with the Blattidæ collected by the Raffles Museum expedition to the Mentawi Islands, to the west of Sumatra. The collection includes 53 species of cockroaches, not less than 19 of them, as well as one genus and one subspecies, being new to science. Out of this number 25 species proved to be common to Sumatra, 17 to Java, 22 to Borneo, and 30 to the Malay Peninsula; but the author is careful to point out that these figures may not indicate the true relationship of the respective faunas. It is remarkable that some cosmopolitan species, like *Stylopyga rhombifolia*, Stoll, and *Periplaneta americana*, L., have not been found, and the author's suggestion is that these hangers-on to white man's civilization have not yet penetrated to the islands.

The journal is well printed, and the two accompanying plates of new species of Blattidæ are well produced.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

May 9th, 1928. — Prof. J. W. Gregory, D.Sc., F.R.S.,
President, in the Chair.

The following communication was read :—

'The Geology of the District around Meifod (Montgomeryshire).' By William Bernard Robinson King, O.B.E., M.A. F.G.S.

The general succession in the district may be summarized as follows :—

SALOPIAN { Banded silts and mudstones (zone of *Cyrtograptus murchisoni* at the base).

Passage-beds—mottled grey and blue mudstones.

{ Pale-grey and maroon muds, with occasional black bands up to 2 inches thick.

Grey-blue mudstones, with calcareous and siliceous bands : many shelly fossils. Probably the base of the Upper

VALENTIAN . { Valentian as defined at Llandovery.

Mudstones similar to the above, but the fauna indicates a Lower Valentian age for the beds.

{ Basal sandstone, with calcareous masses in places. The sandstone fills hollows in the underlying Ashgillian strata.

Unconformity.

ASHGILLIAN . { Buff-grey mudstones. The upper part yields an abundant fauna with *Calymene quadrata*. The lower part yields the *Phillipsinella-parabola* fauna.

CARADOCIAN . { Black graptolite-shale, with basal phosphate-beds resting upon the arenaceous Caradocian.

In this area it has been possible to divide the Caradocian into six subdivisions, each characterized by a special fauna; but it is suggested that the incoming of certain of these faunules is more controlled by the type of sedimentation and food-supply than by time.

The evidence of marked unconformity at the base of the Silurian is striking at certain localities, and in conjunction with the ground on the east shows that the base of the Lower Valentian gradually transgresses the Ashgillian until some 1200 feet of strata are cut out.

The fact that the whole of the Gala, from the zone of *Mono-graptus turriculatus* to that of *M. crenulatus* inclusive, is represented by some 300 feet of fine grey and maroon shales is in striking contrast with the developments in Shropshire and the Midlands or the east, or in Central Wales on the west.

A suggestion is offered to account for the zone of maximum sedimentation being separated from the coastal deposits by a thin but complete succession of beds of fine-grained texture.

May 23rd, 1928.—Prof. J. W. Gregory, LL.D., D.Sc., F.R.S.,
President, in the Chair.

The PRESIDENT remarked that the Society would welcome the news received in a cablegram from Sir T. W. Edgeworth David, K.B.E., F.R.S., that a fauna of annelids and arthropods with well-preserved appendages had been discovered beneath the Middle Cambrian deposits in South Australia. The fossils range from 2000 to 1200 feet below the previously-known fossiliferous horizon. Sir Edgeworth David considers that the fossils are perhaps Lower Cambrian, or that they may be pre-Cambrian and Lipalian. The President emphasized the important bearing of this discovery on the still problematical age of the glacial beds of South Australia, the most fully established of the pre-Carboniferous glaciations.

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END OF THE SECOND VOLUME.



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6a.



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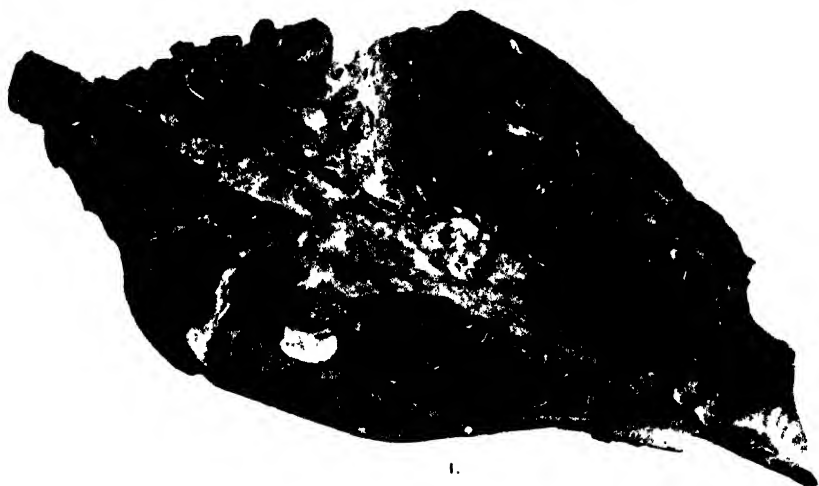
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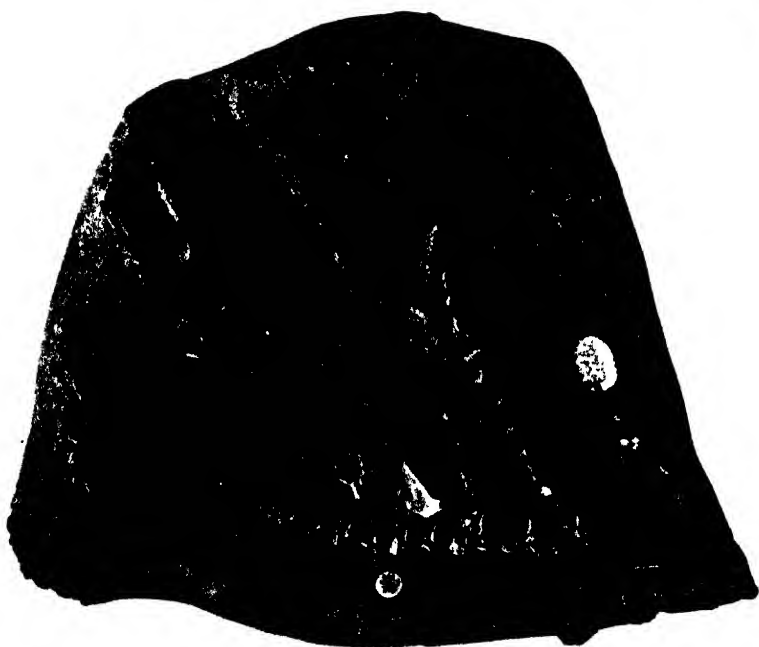
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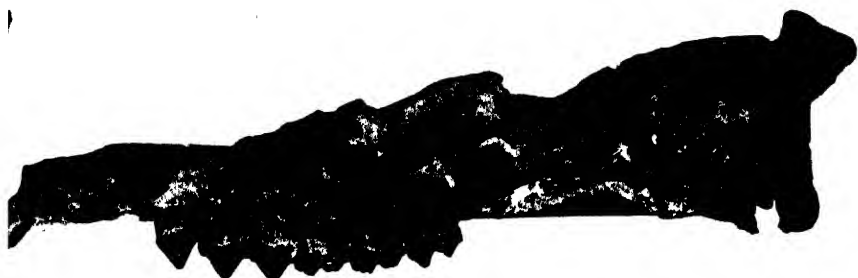
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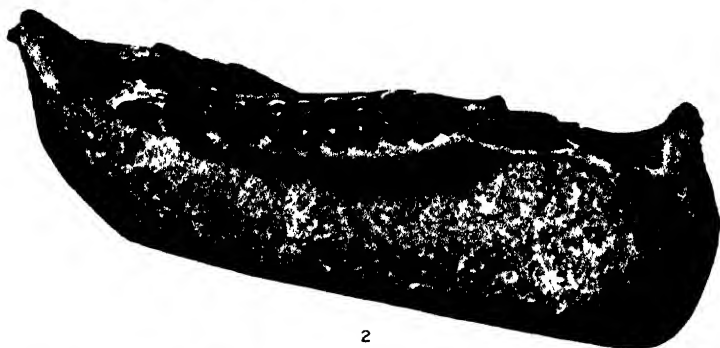
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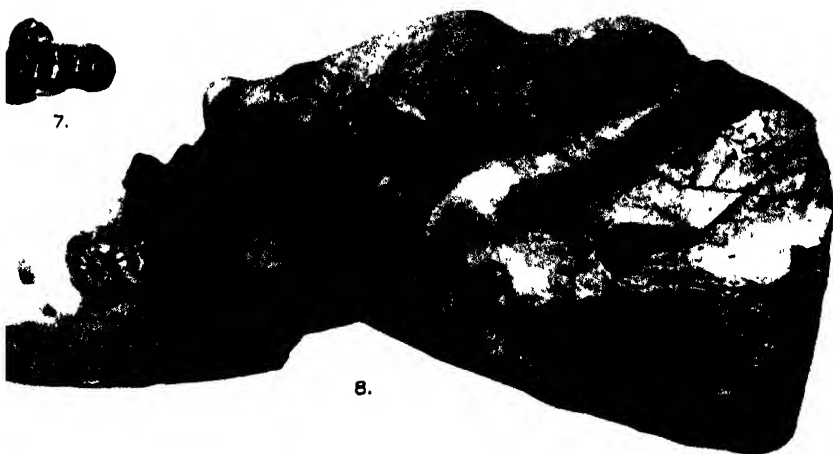
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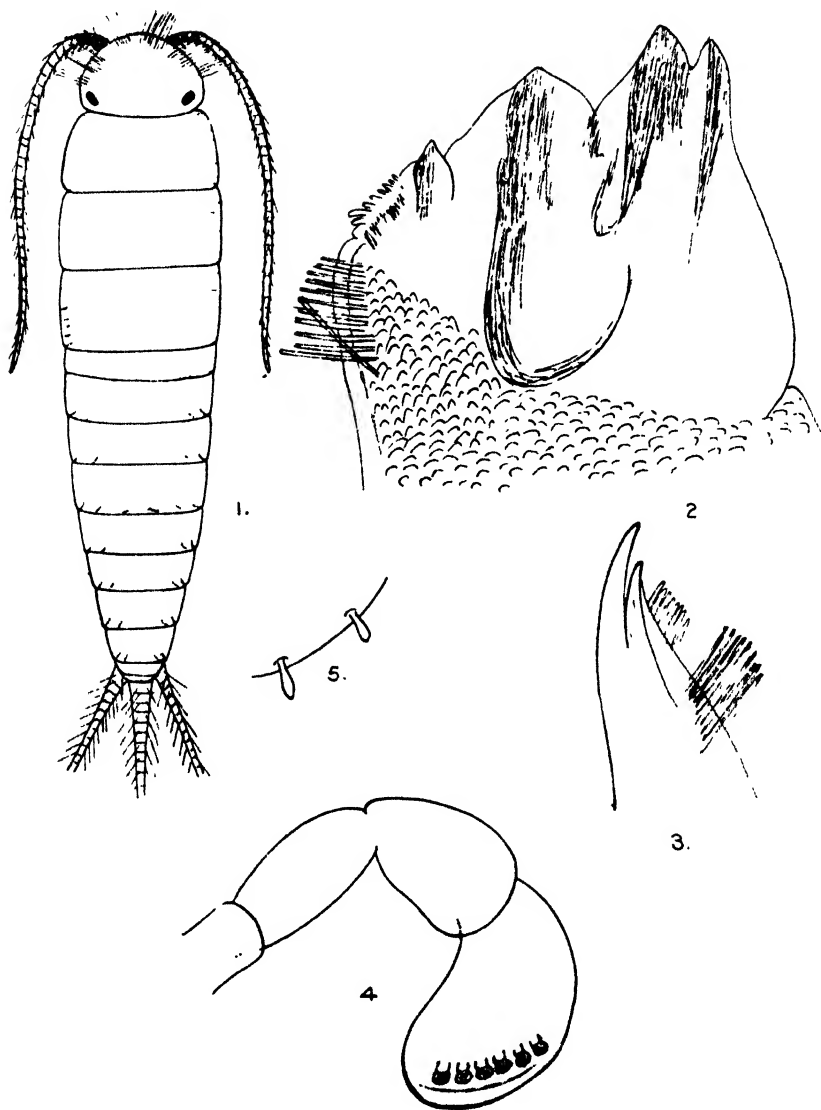
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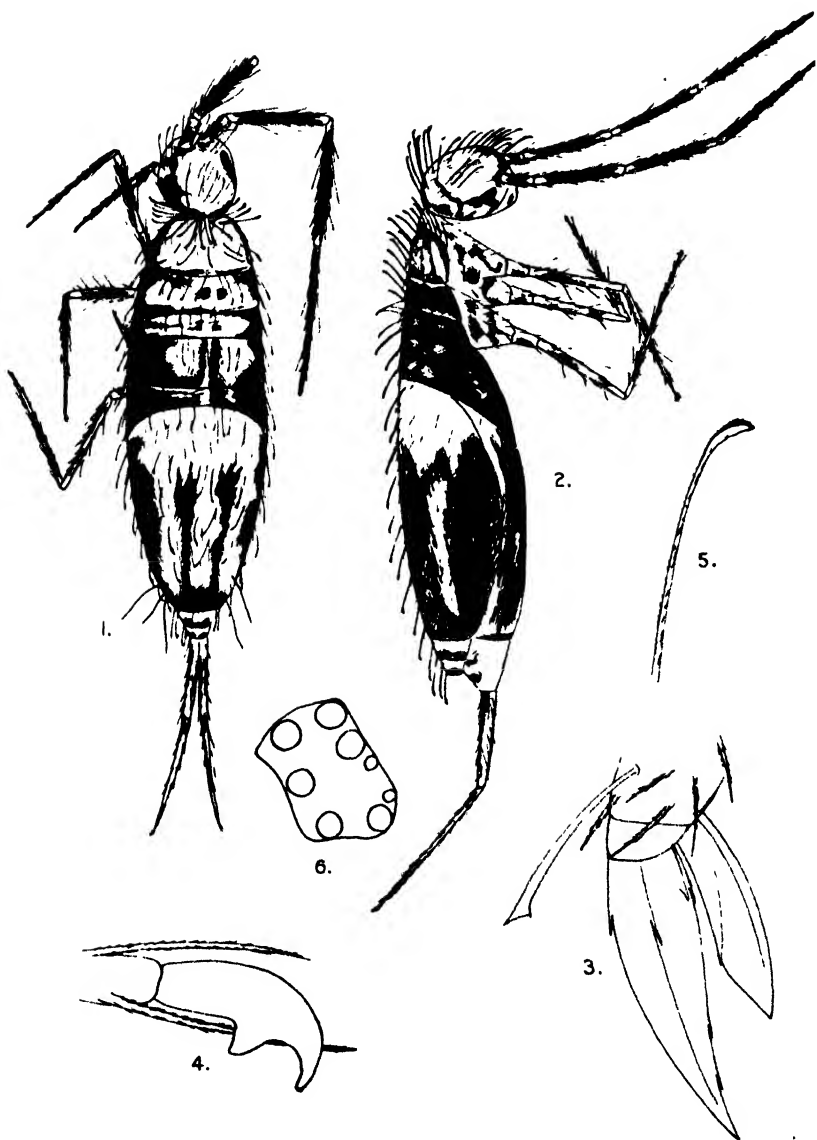
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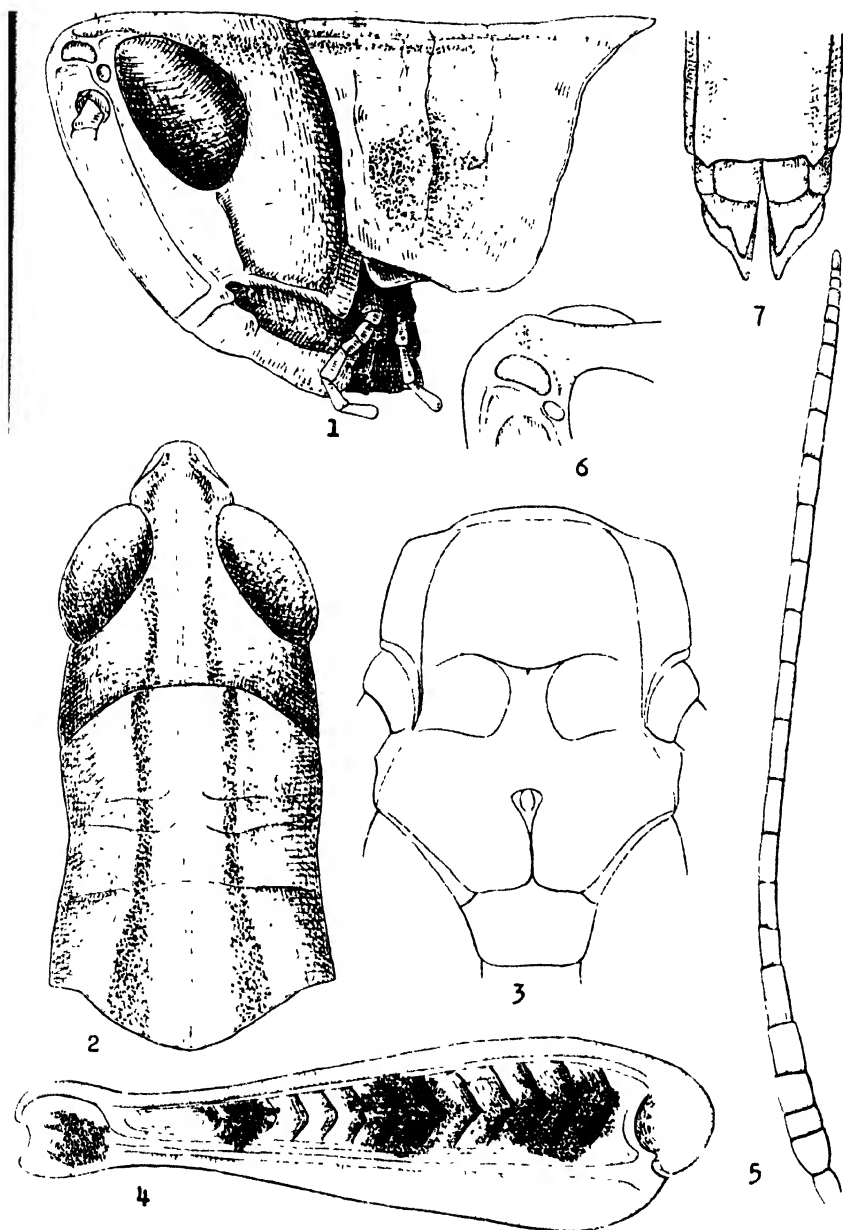
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THYSANURA FROM THE NEW HEBRIDES.



COLLEMBOLA FROM LUNDY ISLAND.



Platypternella pictifemur, sp. n.

FIG. 1.

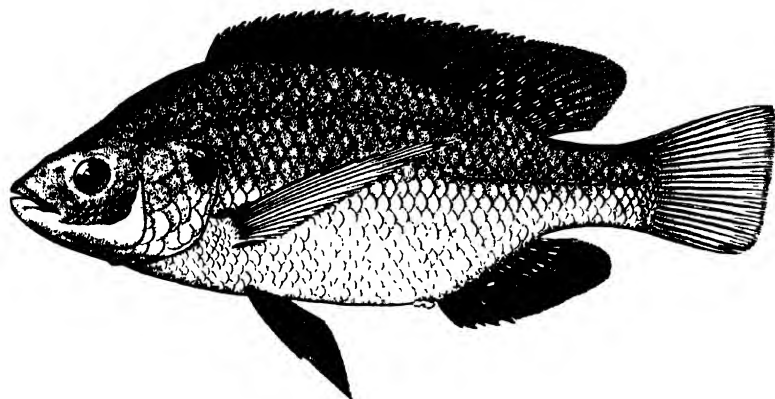


FIG. 2.

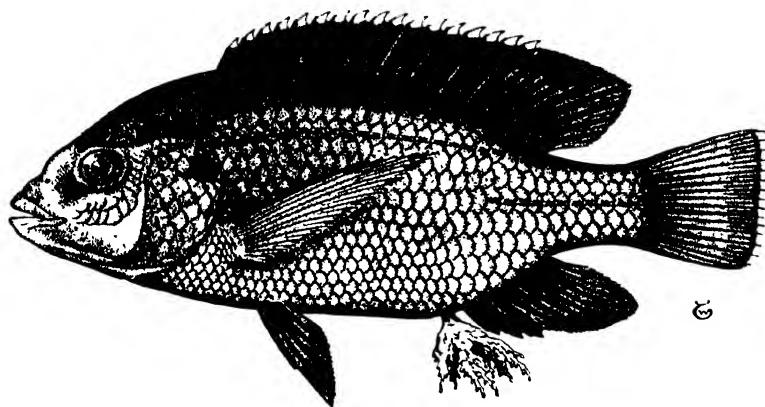
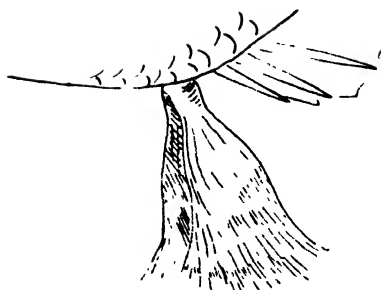
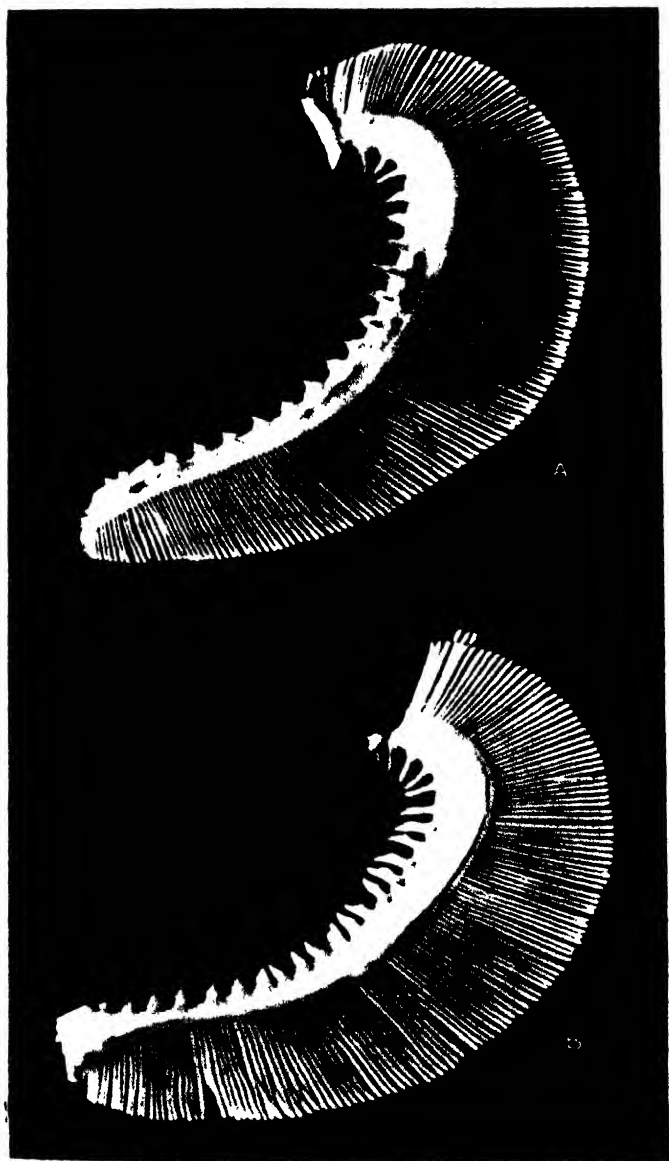


FIG. 3.



A Cichlid Fish from the Victoria Nyanza.



A CICHLID FISH FROM THE VICTORIA NYANZA



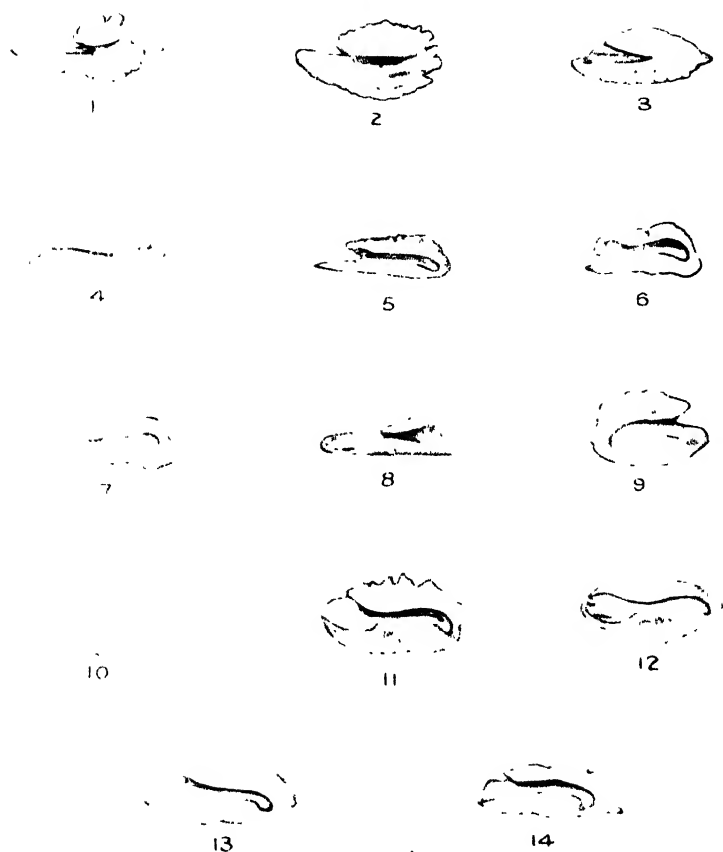
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A CICHLID FISH FROM THE VICTORIA NYAN



C. Allen Frost, del.

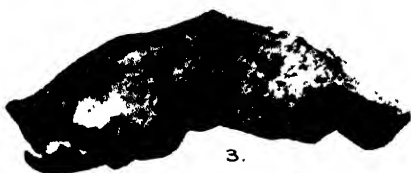
OTOLITHS OF THE SUBORDERS TRICHIUROIDEA,
SCOMBROIDEA, TEUTHIDOIDEA, KURTOIDEA,
ANABANTOIDEA, POLYNEMOIDEA,



1.



4



3.

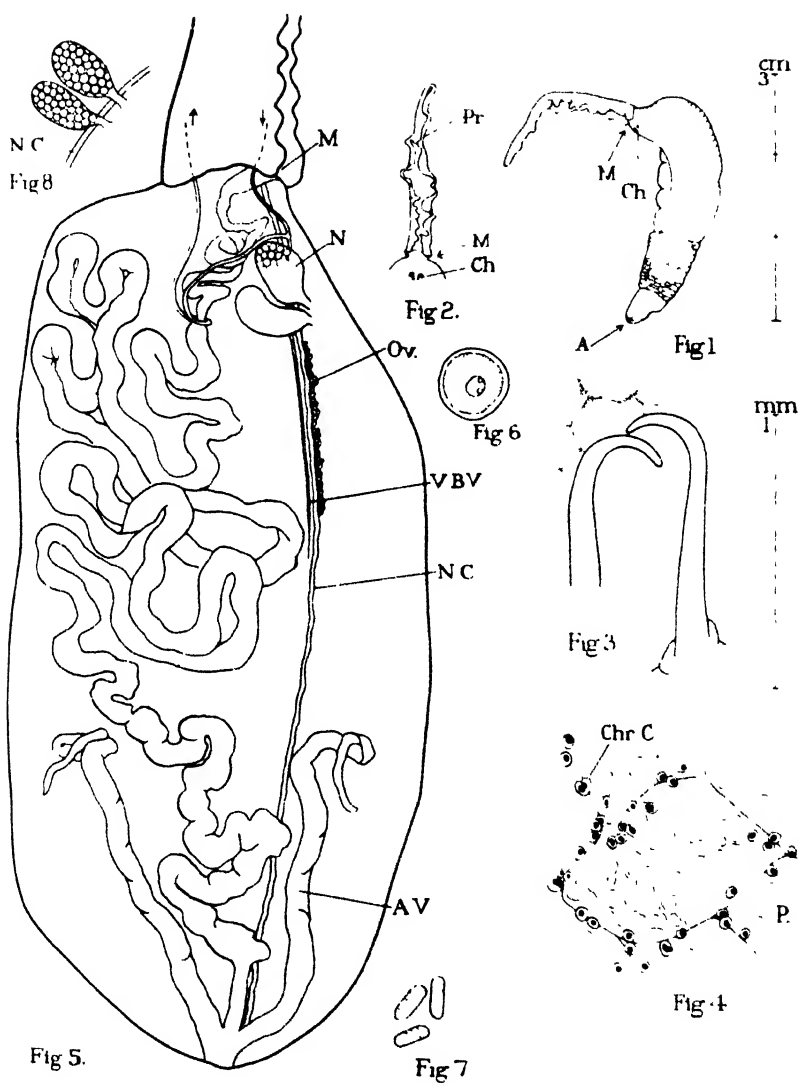


5



2.

H G Herring photo



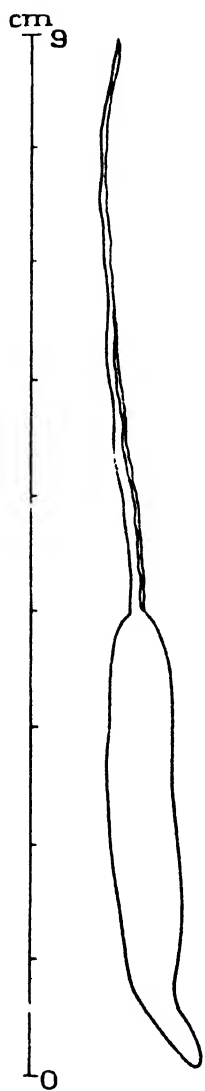


Fig. 9

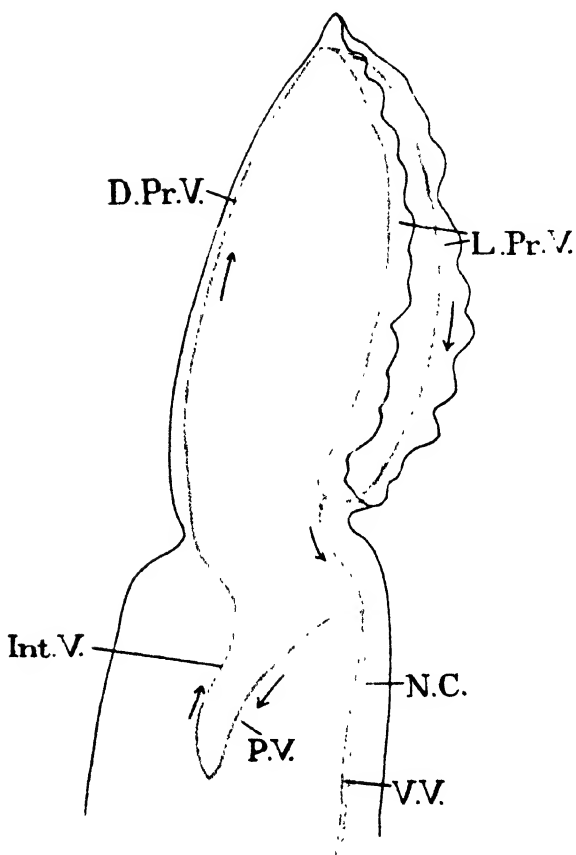


Fig. 10

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